

IN THE UNITED STATES BANKRUPTCY COURT
FOR THE DISTRICT OF PUERTO RICO

In re:	PROMESA Title III
THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of	Case No. 17 BK 3283-LTS (Jointly Administered)
THE COMMONWEALTH OF PUERTO RICO, <i>et al.</i>	Debtors. ¹
In re:	PROMESA Title III
THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO as representative of	Case No. 17 BK 4780-LTS
PUERTO RICO ELECTRIC POWER AUTHORITY, Debtor.	

**EXPERT DECLARATION OF DR. JOSÉ ISRAEL ALAMEDA LOZADA IN
SUPPORT OF THE EMPLOYEES' RETIREMENT SYSTEM OF PUERTO RICO
ELECTRIC POWER AUTHORITY'S OBJECTION TO THE CONFIRMATION OF
THE PUERTO RICO ELECTRIC POWER AUTHORITY'S PLAN OF
ADJUSTMENT**

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¹ The Debtors in these Title III Cases, along with each Debtor's respective Title III case number and the last four (4) digits of each Debtor's federal tax identification number, as applicable, are the (i) Commonwealth of Puerto Rico (Bankruptcy Case No. 17 BK 3283-LTS) (Last Four Digits of Federal Tax ID: 3481); (ii) Puerto Rico Sales Tax Financing Corporation ("COFINA") (Bankruptcy Case No. 17 BK 3284-LTS) (Last Four Digits of Federal Tax ID: 8474); (iii) Puerto Rico Highways and Transportation Authority ("HTA") (Bankruptcy Case No. 17 BK 3567-LTS) (Last Four Digits of Federal Tax ID: 3808); (iv) Employees Retirement System of the Government of the Commonwealth of Puerto Rico ("ERS") (Bankruptcy Case No. 17 BK 3566-LTS) (Last Four Digits of Federal Tax ID: 9686); and (v) Puerto Rico Electric Power Authority ("PREPA") (Bankruptcy Case No. 17 BK 4780-LTS) (Last Four Digits of Federal Tax ID: 3747). (Title III case numbers are listed as Bankruptcy Case numbers due to software limitations.)

1 **I. Introductory Questions**

2 **Q. State your name.**

3 Dr. José Israel Alameda Lozada.

4 **Q. State on whose behalf you are testifying before the Title III Court.**

5 I am testifying on behalf of the Puerto Rico Electric Power Authority Employee's Retirement
6 System ("PREPA ERS" or "SREAAE").

7 **Q. Describe your professional and academic experience and qualifications.**

8 See CV attached as **Annex 2**.

9 **Q. Describe the purpose of your direct testimony.**

10 I will provide expert testimony and an economic study to show that the Plan of Adjustment² is
11 not feasible, due to the macroeconomic impact of the implementation of the Legacy Charge
12 and its effect on Puerto Rico's economy. I will demonstrate that the Legacy Charge will cause
13 a downward economic spiral, as it will negatively impact consumers, production, employment,
14 migration, commercial competitiveness, etc. This entails the eventual failure of PREPA's Plan
15 and, consequently, the Commonwealth's failure to meet its debt service obligations pursuant to
16 its own Plan of Adjustment.

17 **II. The Plan of Adjustment is not feasible.**

18 **Q. Is the Puerto Rican economy competitive and sustainable in the long term?**

19 Puerto Rico's economy is going through structural problems, not cyclical. Puerto Rico is facing
20 secular stagnation which implies a non-growth capacity in the long run. The analysis and
21 information contained in the Certified Fiscal Plans demonstrate this secular stagnation. First,
22 real GNP growth projections rarely achieve over 1% growth. *See CFP, Exhibit 7, page 17.*
23 Second, the Commonwealth will face a deficit from 2026 without any sign of a surplus growth

² All references to "Plan of Adjustment" in this testimony refer to the *Modified Second Amended Title III Plan of Adjustment of The Puerto Rico Electric Power Authority* filed at Case No. 17-04780-LTS, ECF 3296, the exhibits and other materials attached to the Plan of Adjustment, and any and all amendments which were available at the date of this testimony.

24 path. *See* CFP, Exhibit 10, page 20. Finally, federal funds have maintained a temporary and
25 non-sustained short-term growth from 2016 to the present. *See* CFP, Exhibit 3, page 15. Thus,
26 Puerto Rico's economy is not sustainable, and it has no competitiveness in the long term. To
27 make matters worse, the Legacy Charge imposed in PREPA's Plan of Adjustment, as I
28 conclude in my report, has a negative impact, not just for PREPA, but for the economy in
29 general, since a decrease in the economic activity translates into less collections for the
30 Commonwealth's General Fund.

31 **Q. How does this impact affect the feasibility of PREPA's Plan of Adjustment?**

32 Because "feasibility" means and refers to compliance with Section 314(b)(6) of PROMESA as
33 interpreted by the Title III Court, it includes that the debtor entity can both pay its post-petition
34 debt **and provide future public services at a level necessary to its viability.** See *In re Fin.*
35 *Oversight & Mgmt. Bd.*, 637 B.R. 223, 302-03 (D.P.R. 2022). Electricity is not just an essential
36 service; it is a human right. If PREPA cannot sustain its operations, it cannot provide future
37 public services as necessary.

38 The proposed Legacy Charge has a bigger impact on the industrial and commercial sectors, but
39 also affects the welfare of Puerto Rico's residents. The rate increases of the Legacy Charge
40 deviate from the **threshold cost**, estimated at \$0.16, and project an increase without converging
41 with that **threshold cost**. Furthermore, the Legacy Charge deviates from the theories of other
42 economists, including the Board's own expert Andrew Wolfe, who estimated a **threshold cost**
43 of \$0.21. This has a perverse effect on industrial sectors that make up Puerto Rico's economy.
44 Using six (6) equations, this study demonstrates that the Legacy Charge has a negative effect
45 on the real growth of the Puerto Rican economy in the long term. It will also affect demand for
46 kWh in industrial sectors, inducing decreased consumption. This decrease translates into fewer
47 revenues for the Commonwealth's general fund, which risks compliance with the debt service
48 obligations of the Commonwealth Plan of Adjustment. Furthermore, the reduction in energy

49 demand will make PREPA's operations unsustainable, particularly when we consider
50 PREPA's new revenue engagements through the PPPs, such as LUMA and GeneraPR.

51 **Q. How does this impact affect the Commonwealth's ability to meet its debt service
52 obligations?**

53 The imposition of the Legacy Charge, with or without the additional \$0.024 per kWh for the
54 PayGo payments, creates a burden to Puerto Rico residents, as well as the industrial and
55 commercial sector, which decreases revenue for the Commonwealth. Moreover, the payment
56 of the Commonwealth restructured debt, PayGo pension payments and the transfers to the
57 Commonwealth Trust Fund, in addition to the effects of the Legacy Charge, make the CFP
58 unsustainable, as seen in my report. **Annex 1.** By 2031, the projected revenues destined for the
59 payment of restructured debt, PayGo and the Trust fund alone would be between 41.6% and
60 43.4%, meaning that there would be between 60% and 57% available revenue to cover essential
61 services, among the other expenses that need to be covered with the General Fund. Therefore,
62 the imposition of the Legacy Charge makes all the assumptions established in the CFP
63 unsustainable and with them the ability of the Commonwealth to pay debt service pursuant to
64 its own Plan of Adjustment.

65 **I declare under penalty of perjury that the foregoing is true and correct to the best of my
66 knowledge, information, and belief.**



67
68
69 **José I. Alameda Lozada, Ph.D.**
70

April 28, 2023

ANNEX 1

2023

An Assessment of the Legacy Charge Proposed by the Federal Oversight and Management Board: Effects on the Puerto Rican Economy

JOSE ISRAEL ALAMEDA-LOZADA, PH.D., ECONOMIST

Executive Summary

- 1) The Plans approved by the Financial Oversight and Management Board (FOMB) and the Government of Puerto Rico, particularly the Plan of Adjustment,¹ fall upon a(n):
 - a. Economy that is going through a form of stagnation which, in macroeconomics, is referred to as **Secular Stagnation**. Such a state implies a lack of institutional mechanisms and competitive advantage to propel a process of sustained long-term economic growth. **The result is an economy that: a) is fragile and weak; b) is vulnerable to the particular macroeconomic imbalances of Puerto Rico; and c) lacks an endogenous ability to deal with these imbalances.**
 - b. Declining population, as a result of:
 - i. Strong migration outflow, whereby a large amount of endogenous human capital, such as technicians, specialists, physicians, etc., emigrate elsewhere.
 - ii. Reduction in fertility and births.
 - c. Absence of the structural capacity to achieve (tackle with) a path toward sustained recovery for Puerto Rico.
 - d. Dependence on federal funds to maintain short-term, temporary, and un-sustained growth from 2016 until the present. The approval of such funds by the federal government is always a process plagued with great uncertainty and aggressive lobbying, which tends to be burdensome in terms of time and resources.
 - e. Acts of God, such as Hurricanes Irma and María, the earthquakes and the Covid-19 pandemic, which have had collateral effects that further hinder the sustained recovery of the GDP, income, and employment in Puerto Rico.

¹ All references to “Plan of Adjustment” in this testimony refer to the *Modified Second Amended Title III Plan of Adjustment of The Puerto Rico Electric Power Authority* filed at Case No. 17-04780-LTS, ECF 3296, the exhibits and other materials attached to the Plan of Adjustment, and any and all amendments which were available at the date of this testimony.

- 2) Under these conditions, the Plans, with their neoliberal approach in the style of independent countries that are under the International Monetary Fund (IMF) and the World Bank (WB), distance Puerto Rico from the analytical structural framework that is appropriate for Puerto Rico's economy, which only worsens the economic crisis in the mid- and long-term.
- 3) Clearly, as a result of the foregoing, the Plan of Adjustment is unsustainable. That is, it is incapable of addressing the bankruptcy process in the long run. Unless the Plan of Adjustment is modified, so it does not directly and/or indirectly the people of Puerto Rico, it will be unsustainable those of the Puerto Rico Electric Power Authority's (PREPA) residential customers who are most socially and financially vulnerable and have high relative poverty rates. The burden of the payment pursuant to the Plan of Adjustment would fall mostly upon the middle and lower classes.
- 4) This economist's study seeks to provide a scientific analysis of the potential impact of Plan of Adjustment and its effects on the overall economy of Puerto Rico and, therefore, on the Commonwealth of Puerto Rico's (Commonwealth) restructuring plans. Therefore, I will:
 - a. Assess the un-sustained growth of the economy in the short term.
 - b. Measure the potential short-, mid- and long-term effects of the Legacy Charge in the residential, industrial, and commercial sectors under the Plan of Adjustment.
 - c. Analyze the potential adjustments made in the residential, industrial, and commercial sectors in response to the Legacy Charge: a) lower consumption levels (law of demand); b) the replacement effect (use of solar or photovoltaic (PV) power, heat-power, energy-saving equipment, etc.) and c) population level changes.
 - d. Analyze the effects of the foregoing on the feasibility of the Plan of Adjustment and of Commonwealth debt restructuring, respectively.

Purpose of this Report

I will provide expert testimony and an economic study to show that the Plan of Adjustment is not feasible, due to the macroeconomic impact of the implementation of the Legacy Charge and its effect on Puerto Rico's economy. I will demonstrate that the Legacy Charge will cause a downward economic spiral, as it will negatively impact consumers, production, employment, migration, commercial competitiveness, etc. This entails the eventual failure of PREPA's Plan and, consequently, the Commonwealth's failure to meet its debt service obligations pursuant to its own Plan of Adjustment.

Summary of Conclusions

The conclusions of this report are summarized as follows:

- Puerto Rico is facing secular stagnation. Thus, Puerto Rico's economy is not sustainable, and it has no competitiveness in the long term. To make matters worse, the Legacy Charge imposed in PREPA's Plan of Adjustment has a negative impact, not just for PREPA, but for the economy in general, since a decrease in the economic activity translates into less collections for the Commonwealth's General Fund.
- The proposed Legacy Charge has a negative impact on all sectors of electricity consumers, to the extent that it deviates from the threshold cost.
- The imposition of the Legacy Charge makes all the assumptions established in the 2023 Commonwealth Certified Fiscal Plan (CFP) unsustainable and with them the ability of the Commonwealth to pay debt service pursuant to its own Plan of Adjustment.

Outline

- 1) **Chart 1** explains the probable-causation logic. First, an increase in energy rates has a direct effect on industrial, commercial, and residential consumption. Production, employment, and income levels are also affected in the short term. Family wellbeing declines as energy becomes

more expensive. Furthermore, increases in the cost of the kWh have an indirect effect on the price of goods and services.

- 2) Macroeconomic adjustments can occur in the distribution chain, which affect prices in various stages. It is likely that adjustments will be made, resulting in lower demand (the law of demand). One adjustment is the replacement effect, which is when economic sectors move toward options for energy independence, such as PV; heat-power; energy-saving systems, etc.
- 3) Another effect is the interindustry effect. An economy is an intricate relationship of purchases and sales between the various industrial components that constitute a country's economic structure. The Input-Output Matrix (IOM)² represents this intricate network of economic relations. Therefore, if agricultural production is affected by high energy costs, then food manufacturing is also affected, which, in turn, affects the wholesale and retail prices of other related sectors in this interindustry network.
- 4) Macroeconomic adjustments are perceived in GDP, Income, and Employment levels; as well as the revenues collections of the Puerto Rico Department of the Treasury (Hacienda) and changes in population levels due to outflow migration.
- 5) Lastly, all of these effects have repercussions on the expected outcomes of Plan of Adjustment, and the Commonwealth debt restructuring. We cannot ignore the lack of a transparent and clear macroeconomic analysis adapted to Puerto Rico's reality, as opposed

2 The Input-Output Matrix (IOM) is an arrangement of rows and columns, represented in the form of a table, which shows the magnitude of intermediate inputs and raw material that economic sectors get from the other sectors within a country's economic structure. Final demand is also included. The IOM allows us to determine the entire structure of an economy, or of any of its productive sectors, and to measure the influence that any variation in the supply and/or demand of a certain type of good has on the production of others. The matrix is used to obtain the multipliers of each sector and their influence on the other sectors, because it summarizes the balance between supply and the utilization of goods and services in an economy. The IOM was devised by Russian economist Wassily Leontief, winner of the Nobel Prize in Economics in 1973.

to the analyses performed in the certified fiscal plans, which are in line with the neoliberal policies of the IMF and WB and applied to sovereign countries with unsustainable debts.

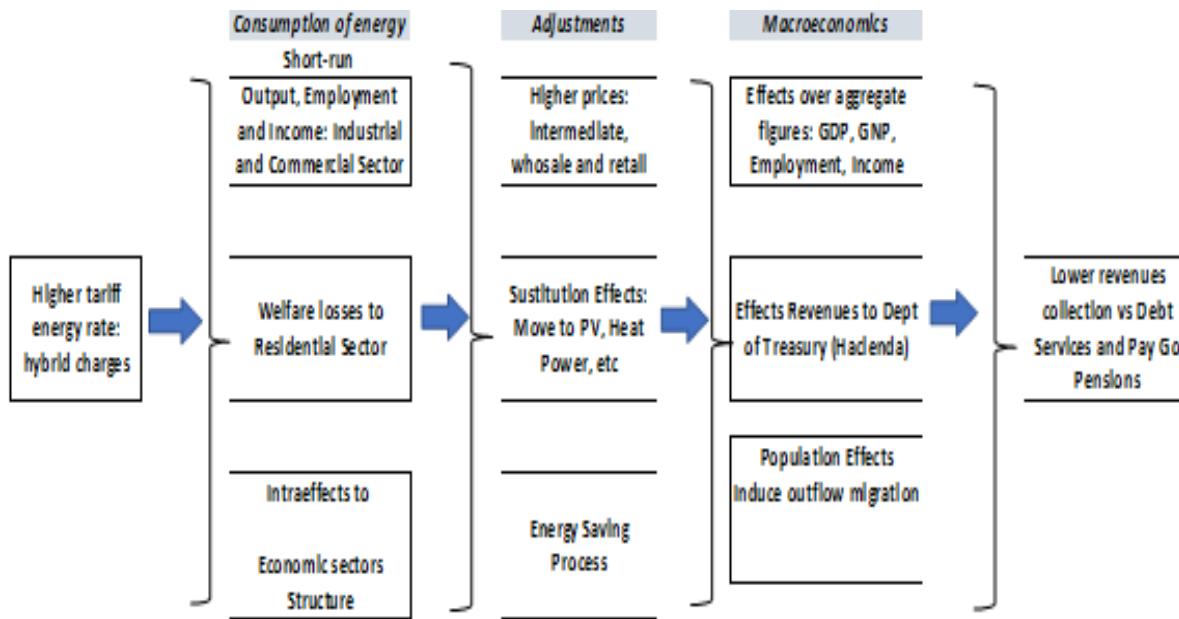


Chart 1 Logical Channels of Legacy Charge Effects

2023 Commonwealth Certified Fiscal Plan

Disclaimer

In March 2023, the FOMB presented the 2023 Commonwealth Certified Fiscal Plan (CFP) which establishes the social and economic path to get Puerto Rico out of bankruptcy and put it on the path to sustainable recovery. However, the CFP contains the following disclaimer:

Any statements and assumptions contained in this document, whether forward-looking or historical, are not guarantees of future performance and involve certain risks, uncertainties, estimates, and other assumptions made in this document. The economic and financial condition of the Government and its instrumentalities is affected by various legal, financial, social, economic, environmental, governmental, and political factors. These factors can be very complex, may vary from one fiscal year to the next, and are frequently the result of actions taken or not taken, not only by the Government and the Oversight Board, but also by other third-party entities such as the government of the United States. Examples of these factors include, but are not limited to:

- Any future actions taken or not taken by the United States government related to Medicaid or the Affordable Care Act;
- The amount and timing of receipt of any distributions from the Federal Emergency Management Agency and private insurance companies to repair damage caused by the Earthquakes and/or Hurricanes María, Irma, and Fiona;
- The amount and timing of receipt of any amounts allocated to Puerto Rico and provided under the Community Disaster Loans Program;
- The amount and timing of receipt of any additional amounts appropriated by the United States government to address the funding gap described herein; and
- The timeline for completion of the work being done by the Puerto Rico Electric Power Authority (“PREPA”) to repair PREPA’s electric system and infrastructure and the impact of any future developments or issues related to PREPA’s electric system and infrastructure on Puerto Rico’s economic growth.

Because of the uncertainty and unpredictability of these factors, their impact cannot be included in the assumptions contained in this document. Future events and actual results may differ materially from any estimates, projections, or statements contained herein. **Nothing in this document should be considered as an express or implied warranty of facts or future events; provided, however, that the Government is required to implement the measures in this 2023 Fiscal Plan and the Oversight Board reserves all its rights to compel compliance . . . (emphasis added).**

This clearly shows the speculative and uncertain nature of this CFP, and, in turn, the conclusions regarding public policy that may be derived from it.

Shortfalls of the CFP

In my judgment, the CFP falls short with regard to the following issues:

- 1) The CFP refers to certain structural adjustments, called structural reforms, that are not relevant to Puerto Rico and are not in keeping with the international legal framework supporting the local economy;
- 2) The CFP invokes the experience of independent, sovereign countries that manage—despite certain limitations—their monetary and fiscal policies and are able to make public policy decisions; but, with regard to the structural reforms proposed for Puerto Rico, they want to compare the local economy with macroeconomic imbalances and adjustment policies, which clearly shows a failure to understand Puerto Rico's structure.
- 3) The growth indexes or values, in addition to the real GNP, that the structural reforms would bring about are not determined by an econometric model, and everything seems to suggest that they are merely the result of a guessing exercise. The CFP does not present a source for these additional growth rates provided by the reforms applied to Puerto Rico.
- 4) To understand these shortcomings of the CFP, we must keep in mind the structural differences and the international legal framework that Puerto Rico operates under:
 - a. Puerto Rico is an unincorporated territory of the United States under the powers of Congress. This is different from independent countries that the CFP uses for comparison. Laws in Puerto Rico are, to a great extent, subject to the power of the federal court and Congress. Many federal laws apply to Puerto Rico, particularly the antitrust laws, but not to independent countries like Peru, Mexico, Spain, etc.
 - b. Local residents are United States citizens and are exempt from having to use a passport or applying for a work or travel visa in the United States, because to go from Puerto Rico to the State of N.Y. you do not need the paperwork that is required of Mexicans, Peruvians, etc. Puerto Rico does not have the legal capacity to make migration policy, like Mexico, Peru, and other countries where the arrival of foreigners is limited or incentivized with special permits or visas.

- c. Puerto Rico does not have the legal capacity to negotiate with other countries bilateral and multilateral international trade relations, either for commerce or special tax treaties.
- d. In the economic sense, it acts as a region of the United States ("It is a state-like economy"). In this sense, Puerto Rico has the same incapacity to promote a monetary policy, establish an official currency other than the dollar, or make fiscal policies as a state of the union. Such decisions are not negotiated between Puerto Rico and the United States. They are imposed by Congress and as a consequence of the legal framework of the United States. The dollar is Puerto Rico's official currency, not by local election, as in countries who have opted for dollarization, but by colonial mandate of the United States.
- e. Puerto Rico does not have the legal capacity to have a central bank and perform the work of a monetary policy, even a limited one. Our central bank is the same as the states'—the Federal Reserve Bank. Mexico, Peru, Spain, Estonia, etc., even within the jurisdictional framework of the European Union, can make monetary policies because they have a central bank. Puerto Rico does not have a central bank and cannot have a currency other than the dollar. Independent countries can.
- f. Puerto Rico's local fiscal policy is limited to Congress's spending policy and automatic stabilizer determinations (i.e. SNAP referred to as "PAN" in Puerto Rico, which is received in blocks; the WIC program; Housing Section 8, etc.). This spending policy applies to Puerto Rico and U.S. citizens who reside in Puerto Rico, with no other internal considerations of economic policy.

5) Additionally, with regard to Energy Reform, the CFP is lacking.

- a. It does not specify the type of reform it refers to when comparing Puerto Rico to other countries such as Mexico, Perú, etc. It does not establish the legal and technical details of the reform implemented and their outcome; whether or not those reforms were a

privatization where public assets are sold to a private company, or a type of partnership between the private sector and the government.

- b. With respect to the public-private partnerships (PPP), the CFP fails to specify the conditions present in the contracts between the private sector and PREPA, and the effects of these contracts.
- c. It fails to specify in what social, economic, and technical conditions these utility companies went to other countries that were or were not similar to Puerto Rico at a given historical moment. A particular characteristic of Puerto Rico is that there has been a reduction in the demand for (consumption of) electricity, which makes the depressive economic conditions existing at the time of the negotiation notable.
- d. It fails to present any study whatsoever to demonstrate the additional growth in the real GNP resulting from the energy reform of 0.10% for fiscal years 2024, 2025 and 2026. In other words, the CFP was certified with claims of an increase in the real GNP, without any econometric evidence or exercise whatsoever.

Mexico, a country cited in the CFP, just announced the nationalization of power companies.³ President Ángel Manuel López Obrador refers to a “new nationalization of the electric power industry,” as it is very important in order for Mexico to maintain public companies, instead of, he stated, and I quote, “betting on the privatization of social activities and strategic activities for the people and for the nation.”⁴ This nationalization policy arises out of the need to purchase the 13 power plants, because this would guarantee that electric power prices will not increase in the country, as has occurred in Spain. In this country, electrical energy is regulated by the laws of supply and demand within the market and results in the Iberdrola company charging very high rates to Spanish citizens.⁵

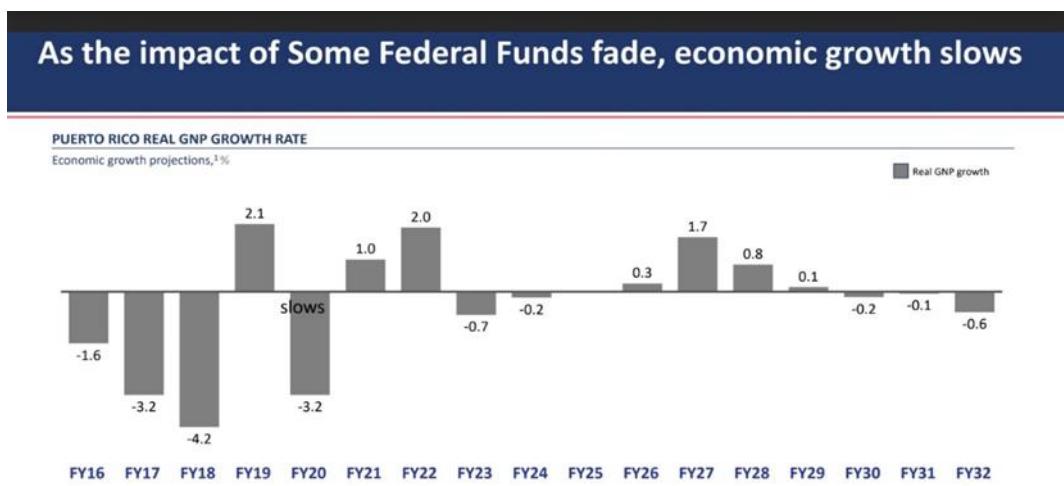
³ See AMLO Nationalizes Electricity; Purchases 13 Plants From Iberdrola, <https://polemon.mx/amlo-nacionaliza-la-electricidad-le-compra-13-plantas-a-iberdrola/>.

⁴ *Ibid.*

⁵ *Ibid.*

Fundamental Conclusions for Economic Growth and the Fiscal Deficit

The CFP presents a long-term negative trend. (2023 CFP, Vol.1, page 10). In 2024, a -0.2% growth is expected, and in 2025, 0% growth. It is observed that the real GNP growth is close to 0% or has a negative value, except for FY 2027.

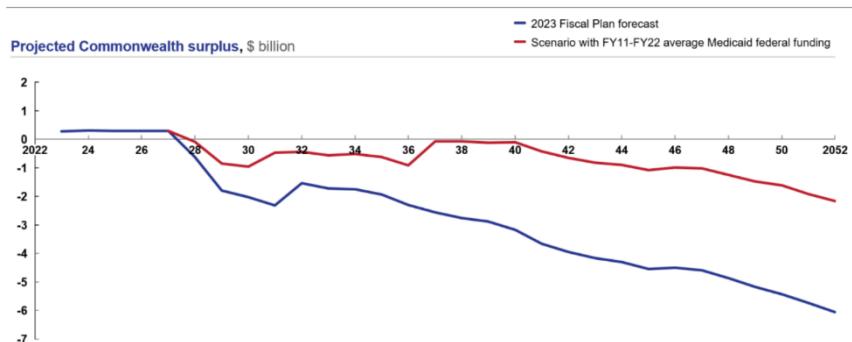


1) FY2016-FY2021 actuals sourced from the 2021 Statistical Appendix to the Economic Report to the Governor. FY2022 and beyond are 2023 Fiscal Plan model estimates and projections

Graph 1 Puerto Rico Real GNP Growth Rate. Source: 2023 Commonwealth Certified Fiscal Plan, Vol. 2, page 20.

A relevant result presented in the CFP is the Commonwealth Projected Budget Gap. (2023 CFP, Vol.1, page 20). The Commonwealth would fall into fiscal deficits very close to 2027 and 2028. The worst part is that it would not recover in the long run and would continue to have budget gaps between 2028 and 2052. This is another indicator of the economy's secular inability to recover a rate of sustained growth that allows the Commonwealth to take on new debt and pay its existing debt, even if it is restructured.

EXHIBIT 10: COMMONWEALTH PROJECTED BUDGET GAPS/SURPLUS



Graph 2 Commonwealth Projected Budget Gaps/Surplus

Federal Funds as the Most Important Engine of Non-Sustainable growth.

The catastrophic events that have taken place in the past years led to a significant allocation of resources by Congress, mostly through its agencies. Three events are sources of historical allocation: Hurricanes Irma and María (2017), the earthquakes, which especially damaged the southern region of Puerto Rico (2019), and the Covid-19 Pandemic (2020 onward).

The Central Office for Recovery Reconstruction and Resiliency (COR3) is the local agency designed to manage these resources, which amount to \$81.8 billion: FEMA funds amount to \$45.3 billion; CARES Act funds amount to \$2.26 billion; American Rescue Plan Act funds amount to \$4.02 billion, and others \$30.26 billion. However, of the grand total allocated, only 34.2% has been used. The big question is whether Puerto Rico would lose a large part of these allocated funds, especially from FEMA and others, due to ineffective utilization thereof.

Table 1 Federal Funds under the Agency COR3 Allocated, Obligated and Disbursed: 2023. Source: Data Obtained from COR3, FEMA, AAFAF & Department of Treasury, <https://recovery.pr.gov/en/financial-analysis/financial-summary#>

	Allocated	Obligated	Disbursed	% Disbursed to Allocated
FEMA Funds	\$45.30	\$44.56	\$17.70	39.07%
CARES Act	\$2.26	\$2.21	\$2.19	96.90%
American Rescue Plan Act	\$4.02	\$2.89	\$2.89	71.94%
Other Funds	\$30.26	\$25.37	\$5.28	17.45%
Total COR 3 Federal Funds	\$81.80	\$75.00	\$28.00	34.23%

Table 1 presents the contribution of federal funds to the growth of the nominal GNP. Between 2020 and 2025, their contribution is 2.5%, that is 21% of the nominal GNP. The expected nominal growth of the GNP is -0.73%, without deducting the effects of inflation.

It is clear that Puerto Rico's economy has subsisted with the federal funds it receives, as it does not appear to have the capacity for sustainable growth. In absence of a model for socioeconomic growth that will support long-term growth, the local economy's habitual source of support is, has been, and apparently will continue to be, federal funds. Despite the fact that about \$10 billion in federal funds are received there on a yearly basis, Puerto Rico will not be able to grow again until fiscal year 2027, and it will grow merely 1.7%, according to the CFP. Following this CFP, the economy will go back to a period of stagnation and contraction. It is clear that the CFP certifies that the economy is in

secular stagnation, which implies that the economy does not have the long-term capacity to get on the path to sustainable growth, without the extreme need for federal funds. The CFP does not forecast a quick recovery of sustained growth of say a positive growth of 2.0%. In this CFP, the FOMB had to revise and lower that previous result. The 2022 Commonwealth Certified Fiscal Plan estimated a growth of 2.6%, but without the arrival of the federal funds, the result would have been worse. Puerto Rico's economy would have fallen 0.4%. Puerto Rico's economy is growing less than expected, and the forecast is that this will not improve in the next decade, even with the arrival of large sums of federal funds. In the current fiscal year, a 0.7% decline is expected—the first decline in three years. Economic growth will be close to zero in the following three years, with a 1.7% upturn in 2027, followed by a slowdown and period of contraction in fiscal year 2030.

Table 2 Contribution to nominal GNP growth. Federal Funds and nominal GNP of Puerto Rico

Year	GNP nominal	Federal Funds	Rate of changes		Contribution to growth	
			GNP nominal	Federal Funds	GNP nominal	Federal Funds
2016	\$82.8	ND				
2017	\$80.1	ND				
2018	\$74.4	ND				
2019	\$73.5	\$4.5				
2020	\$70.9	\$6.3	-3.5%	40.0%	2.45%	
2021	\$71.7	\$8.0	1.1%	27.0%	2.40%	
2022	\$71.4	\$9.9	-0.4%	23.8%	2.65%	
2023	\$70.6	\$10.1	-1.1%	2.0%	0.28%	
2024	\$70.4	\$10.1	-0.3%	0.0%	0.00%	
2025	\$70.3	\$10.2	-0.1%	1.0%	0.14%	
Yearly average						
2019-2025	\$498.8	\$59.1	-0.73%	21.11%	2.50%	

Note 1 Last column on the right-hand side measures the contribution to growth of Federal Funds. It is the share of Federal Funds to nominal GNP times the rate of growth on federal funds data.

The influx of federal funds has given a false impression of recovery because the funds cover up the secular and structural weaknesses that persist and hinder long-term sustainable economic growth.

Net Revenues to General Fund

An erroneous claim of evidence of recovery made by the FOMB and the Commonwealth was based on the fact that extraordinary revenues were received this year. Indeed, between 2018 and 2022, these increased from \$9.3 billion to \$11.3 billion. However, this analysis failed to make a necessary comparison with the economic base, which is the nominal GNP. The ratio between Net Revenues to the General Fund and the Nominal GNP was 16.1% in 2019 and 14.7% in 2022—very

similar to the period from 2000 to 2004, where it was 15% to 16%. Therefore, we can conclude that there is no evidence on which to base a claim for record revenues.

Table 3 Net Revenue to General Funds, Nominal GNP and Ratio Net Revenue to GNP FY 2000-2022. Source: Planning Board, Income and Product Accounts.

Fiscal Year	Net Revenues to General Fund	Nominal GNP	Ratio Net Revenue/GNP
2000	\$6,943.6	\$41,418.6	16.8%
2001	\$6,962.1	\$44,046.6	15.8%
2002	\$7,454.4	\$45,071.3	16.5%
2003	\$7,841.7	\$47,479.4	16.5%
2004	\$7,985.4	\$51,826.5	15.4%
2005	\$8,305.7	\$54,861.9	15.1%
2006	\$8,541.2	\$57,854.3	14.8%
2007	\$8,862.5	\$60,642.7	14.6%
2008	\$8,359.0	\$62,703.1	13.3%
2009	\$7,710.2	\$63,617.9	12.1%
2010	\$7,716.1	\$64,294.6	12.0%
2011	\$8,158.3	\$65,720.7	12.4%
2012	\$8,667.4	\$68,085.7	12.7%
2013	\$8,502.2	\$68,944.9	12.3%
2014	\$9,036.9	\$68,797.5	13.1%
2015	\$8,960.9	\$69,602.0	12.9%
2016	\$9,175.3	\$69,985.2	13.1%
2017	\$9,334.9	\$69,049.5	13.5%
2018	\$9,313.2	\$67,601.1	13.8%
2019	\$11,375.9	\$70,765.1	16.1%
2020	\$9,288.5	\$70,508.7	13.2%
2021	\$11,688.0	\$73,580.8	15.9%
2022	\$11,327.0	\$76,892.0	14.7%

Moreover, the claim of historical revenues is marred by increases in consumer prices. To the extent that we have higher price levels, our revenues will also be higher, *ceteris paribus*. The **Table 3** shows how, between the first half of fiscal year 2022 to 2023, the increase in Net Revenues was 4.5%; taxable sources, 5.2%, and non-taxable sources, 6.8%. In the very same period, the Consumer Price Index increased by 6.4%. These revenues are clearly also influenced by higher price levels.

Table 4 Net Revenues to General Fund and Inflation in Puerto Rico: 2021-22 to 2022-23

	July to January 2021-2022	July to January 2022-2023	Rate of Growth
(thousand of dollars \$)			
Net Revenues to General Fund	\$6,268,276	\$6,549,529	4.5%
From Taxable Sources	\$5,896,072	\$6,201,289	5.2%
From Non Taxable Sources	\$209,655	\$224,006	6.8%
Other sources (Rum shipment excise taxes)	\$162,549	\$124,234	-23.6%
Consumer Price Index, Average	123.3	131.2	6.4%
Base (dic =2006)			

Note 2 Treasury Department collects \$1.1268 billion during the month of January of FY 2023, Press Release/ Monday, March 6, 2023

Employment and Labor Force Participation Rates

The CFP seems to claim that the decline in the unemployment rate in Puerto Rico, along with the increase in the employment rate, are evidence of a trend toward recovery. Of course, it fails to show that this is a permanent trend or that it points to a sustainable trend in the long run.

As Puerto Rico continues to emerge from the COVID-19 pandemic, the unemployment rate continues to decline in a trend started in 2010 reaching a historic low of 5.8% in August 2022. While unemployment is still relatively high compared to the mainland, Puerto Rico has narrowed the gap to just over 2 percentage points. In addition, labor force participation, despite being below other U.S. states, continues to rise. **This increase is likely related in part to the recent expansion of the EITC program in 2021.** (CPF, Vol. 1, Page 15)(emphasis added).

Table 5 presents information from the Department of Labor and Human Resources regarding the labor market. **Graphs 3, 4 and 5** present the civilian non-institutional population,⁶ labor force and employment rates. As you can see, the reduction in the local population has caused both the civilian population and the labor force to decrease, which affects the typical interpretation of employment, unemployment, and participation rates. The employment rate increased from 2018 to 2022 from 972,000 to 1,124,000. Therefore, the unemployment rate decreased from 19.2% to 9.6%. However, this reduction is not a reflection of solid and sustainable recovery.

Let us note that none of the three labor-market variables—civilian population, labor force and employment rate—show that their increase has reached its peak level, which marked the arrival of the 2016 recession. With regard to the employment rate, there is a gap of 149,000 employees below the 2007 employment rate, which was of 1,263,000 employed individuals. We must note that the employment rate in 2022—1,124,000 employed individuals—was very similar to the employment rate in 2010—1,075,000 employed individuals. However, the unemployment rate in 2010 was 16.5%, and the participation rate, 36.9% (in 2022, it was 40.0%).

Therefore, the reduction of the unemployment rate is not a sign of solid recovery in terms of employment and labor force participation, but a sign of a shrinking population, which causes a

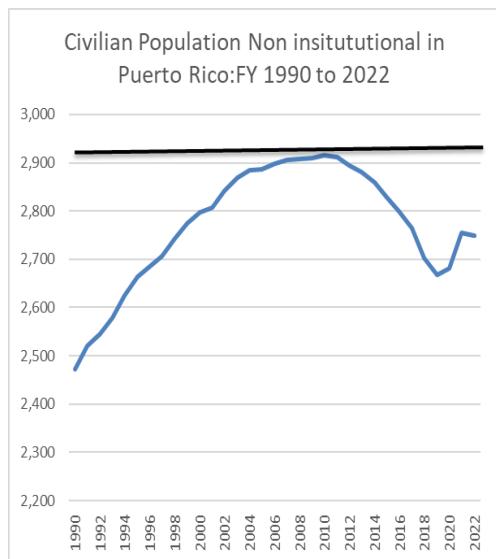
⁶ Civilian noninstitutional population is defined as those persons aged 16 or older residing in Puerto Rico, who are not inmates or institutionalized, that is, in penal institutions, mental facilities, homes for the elderly, etc., and who are not on active duty in the U.S. Armed Forces.

reduction in civilian population and labor force rates. This population decline is due, in part, to the emigration of individuals to the United States, as a result of which there are less people of working age engaging in efforts to seek and maintain employment in Puerto Rico. This causes the unemployment rate to drop, not because these individuals have found work in Puerto Rico, but because they have ceased to seek employment in Puerto Rico.

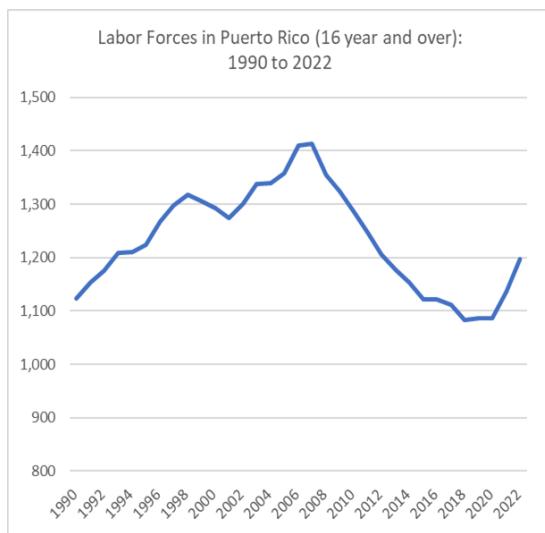
Table 5 Labor Market Profile in Puerto Rico. Source:

http://www.mercadolaboral.pr.gov/Tablas_Estadísticas/Fuerza_Trabajadora/T_Serie_Historica.aspx

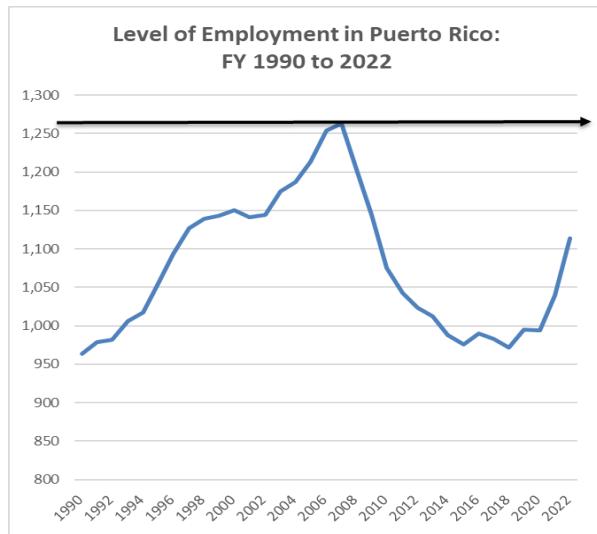
Fiscal Year	Civilian Population	Labor Forces	Employment	Unemployment	Employment rate	Participation rate	Unemployment Rate
1990	2,473	1,124	963	160	38.9%	45.5%	14.2%
1991	2,520	1,154	979	175	38.8%	45.8%	15.2%
1992	2,547	1,175	982	194	38.6%	46.1%	16.5%
1993	2,579	1,209	1,006	203	39.0%	46.9%	16.8%
1994	2,625	1,210	1,017	193	38.7%	46.1%	16.0%
1995	2,664	1,224	1,055	169	39.6%	45.9%	13.8%
1996	2,685	1,268	1,093	175	40.7%	47.2%	13.8%
1997	2,706	1,298	1,127	170	41.6%	48.0%	13.1%
1998	2,743	1,318	1,139	180	41.5%	48.0%	13.7%
1999	2,774	1,306	1,143	163	41.2%	47.1%	12.5%
2000	2,797	1,292	1,150	142	41.1%	46.2%	11.0%
2001	2,808	1,274	1,141	133	40.6%	45.4%	10.4%
2002	2,842	1,301	1,144	156	40.3%	45.8%	12.0%
2003	2,870	1,337	1,175	162	40.9%	46.6%	12.1%
2004	2,884	1,339	1,187	152	41.2%	46.4%	11.4%
2005	2,886	1,357	1,213	144	42.0%	47.0%	10.6%
2006	2,899	1,410	1,254	156	43.3%	48.6%	11.1%
2007	2,906	1,413	1,263	150	43.5%	48.6%	10.6%
2008	2,908	1,355	1,203	152	41.4%	46.6%	11.2%
2009	2,910	1,325	1,144	181	39.3%	45.5%	13.7%
2010	2,915	1,285	1,075	210	36.9%	44.1%	16.3%
2011	2,911	1,245	1,043	201	35.8%	42.8%	16.1%
2012	2,895	1,206	1,023	183	35.3%	41.7%	15.2%
2013	2,880	1,177	1,012	165	35.1%	40.9%	14.0%
2014	2,859	1,153	988	165	34.6%	40.3%	14.3%
2015	2,829	1,121	976	145	34.5%	39.6%	12.9%
2016	2,799	1,121	990	131	35.4%	40.1%	11.7%
2017	2,765	1,111	983	128	35.6%	40.2%	11.5%
2018	2,703	1,083	972	111	36.0%	40.1%	10.2%
2019	2,668	1,087	995	92	37.3%	40.7%	8.5%
2020	2,681	1,087	994	93	37.1%	40.5%	8.6%
2021	2,754	1,136	1,040	96	37.8%	41.2%	8.5%
2022	2,749	1,197	1,114	83	40.5%	43.5%	6.9%



Graph 3



Graph 4



Graph 5

The Impact of Extraordinary Events such as Hurricanes Irma and María

In Puerto Rico, many hypothesize that atmospheric events do not have long-term effects on the economy, and that federal funds tend to permanently relieve the hardship caused by such events. Nevertheless, this position lacks scientific validity, to the extent that these events can have longer-lasting effects than what is assumed by popular opinion.

Economists Solomon Hsiang and Amir Jina use data from 6,700 cyclones between 1950 and 2008 and address the following question: Do atmospheric events have more permanent, that is, non-transitory, effects on the economy? Their conclusion is that they do: "The data reject hypotheses that disasters stimulate growth or that short-run losses disappear following migrations or transfers of wealth."⁷ Geography influences economic development, at least in the initial conditions and the design of institutions to mitigate or reduce the vulnerability of growth. The conclusions of the aforementioned economists are:

- Cyclones (hurricanes) arise more frequently than financial, banking, and other crises, over the same population.
- After a strong hurricane, there is no immediate recovery, and its effects can last up to 20 years.
- Both wealthy and poor countries are affected. There is no distinction.

⁷ Solomon M. Hsiang and Amir S. Jina, The Causal Effect Of Environmental Catastrophe On Long-Run Economic Growth: Evidence From 6,700 Cyclones, NBER Working Paper 20352 (July 2014).

- Greater losses are suffered in countries that have less experience with cyclones.
- Two decades later, the pattern of income reduction is 7.4% of the real GDP per capita.
- The growth of the GDP remains depressed for 15 years, taking the affected economy out of a positive-growth trend.
- In 1 out of 10 cyclones, the growth of per capita income in the affected country drops by 7% during the two subsequent ones.
- The total impact of 4,174 cyclones from 1950 to 2008 had the effect of reducing the global GDP by 1.27%.

	Effect on income per capita	Years for recovery
Temperature Increase (+1 degree Celsius) a/	-1.0%	10
Civil War	-3.0%	10
Tax increase	-3.1%	4
Standard Deviation Cyclones	-3.6%	20
Banking Crisis	-7.5%	10
Financial Crisis	-9.0%	2

a/ poor countries

The 2017 Hsiang and Houser article, using the Hsiang-Jina model,⁸ arrives at the same conclusion: “[The effects of Hurricane María] could lower Puerto Rican incomes by 21 percent over the next 15 years — a cumulative \$180 billion in lost economic output.”⁹ We can conclude that a hurricane, such as Hurricane María, which is uncommon and powerful, had effects on the long-term growth of an economy already experiencing problems of secular growth.

⁸Solomon Hsiang and Trevor Houser, Don’t Let Puerto Rico fall into Economy Abyss, New York Times (29 sept 2017).

⁹ *Ibid.*

Impropriety of Structural Reforms under the IMF and WB Framework

The structural reforms presented in all of the CFP lack a relevant and transparent outline that would allow us to understand, without any room for doubt, the premises, postulates, and econometric measurements used to arrive at these growth rates for each one of the reforms. As a question of fact, in each of the Certified Fiscal Plans previously presented, these growth values are changed without providing any explanation whatsoever. They seem to be merely speculative numbers with no scientific substance. It has been acknowledged that the labor reform, which was deemed to be structural in nature and necessary to foster growth, has done the exact opposite.

The structural reforms that the IMF faces from a neoliberal philosophy are based on three interrelated pillars:

1. External opening or liberalization in the functioning of markets;
2. Impulse to privatization, PPP and other private-sector initiatives instead of government;
3. Deregulation of main markets.

Regarding external openness, there is a constant mention of the need for the allocation and mobilization of resources to conform to the guidelines of the international market. Privatization corresponds to institutional changes that tend to reduce the space occupied by the State in economic and financial matters. This is achieved by transferring from public companies to the private sector through transfer or sale of public companies or co-participation in strategic services or physical output. Finally, the IMF is in favor of deregulation in the functioning of markets, which is equivalent to restricting the regulatory capacity and functions of the State.

Examples of such structural reforms include measures that (i) maintain low inflation and given manageable fiscal and current account balances, (ii) promote competition and trade openness; (iii) improve a country's business environment by enforcing contracts and rule of law, enhancing the quality of public bureaucracy, and minimizing corruption; (iv) ensure the safety and soundness of financial institutions; (v) enhance labor productivity by providing infrastructure capital; and (vi) promote equality of opportunity to access public services.

The estimated impact of structural reforms is based on work by the International Monetary Fund on labor reforms implemented in Europe (e.g., Spain and Estonia) and South America (e.g., Peru and Colombia), among other jurisdictions; utilities reform in Latin America; broadly accepted metrics for measuring improvement in the World Bank's Doing Business Rankings (as well as examples of growth experienced by countries that have implemented such reforms) and education reforms in Europe and elsewhere. Structural reform benchmarks, to the extent possible, come from nations or jurisdictions with constraints similar to Puerto Rico's (e.g., limited monetary policy options and high informal labor markets).

Reforms related to power sector / energy and ease of doing business are projected to increase GNP by 0.60% by FY2026. Human capital and welfare reform is expected to add another 0.15% in FY2025. K-12 education reforms should add another 0.01% annual impact beginning in FY2037, resulting in total GNP increase from structural reforms of 0.75% by FY2026 and 0.91% by FY2052. (CFP, Vol. 2, Page 10, Section 2.3)(emphasis added).

Meanwhile, the experience in Latin America has not been addressed entirely by the FOMB, especially the issue of the expected growth and prices of the GNP, due to that energy reform.

Summary of the Proposed Effects of the Structural Reforms

Economists Martín Guzmán and Daniel Santamaría presented a comprehensive picture of the proposed effects of IMF and WB type of structural reforms on the growth of the GNP in Puerto Rico.¹⁰

Table 6 and **Graph 6** set forth the results contained in their presentation. I summarize them as follows:

1. The cumulative effect of the impact of these reforms is increasingly less over time.
2. The three 2018 Certified Fiscal Plans showed greater optimism toward the effects on growth than subsequent ones, starting in 2019. In the 2018 Commonwealth Certified Fiscal Plan, the ultimate cumulative effect reached 1.8 additional growth percentage points. In the 2021, 2022 and 2023 Commonwealth Certified Fiscal Plan, it barely reached a percentage point. Specifically, it was 0.75.
3. The effects seem to be split up into two groups. First, the three from 2018, and second, from 2019. They suspect that the effects of Hurricanes Irma and María add pessimism to the ultimate effect of these reforms.

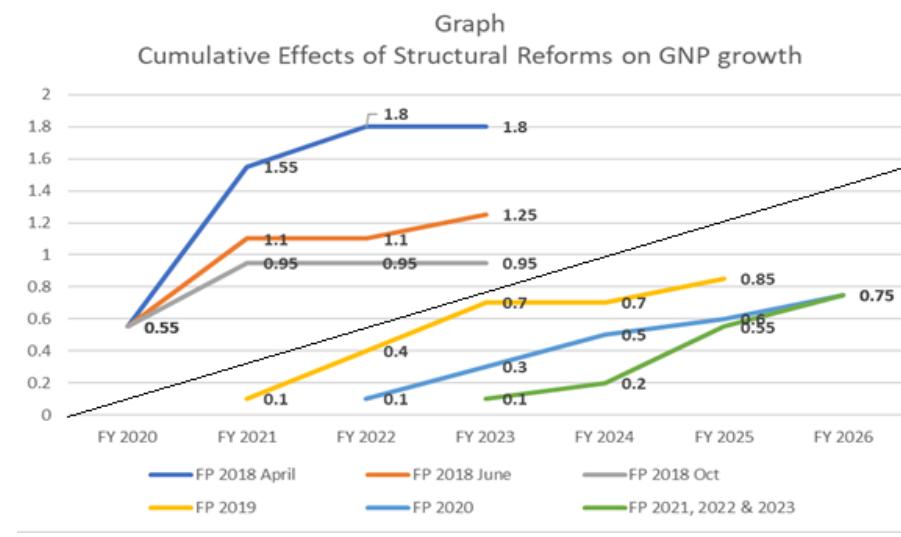
¹⁰ Martín Guzmán y Daniel Santamaría, Overview of Puerto Rico's fiscal, debt and growth policies, Espacios Abiertos (2023).

4. These results validate that Puerto Rico isn't going through a cyclical problem, but through secular stagnation.
5. Nevertheless, it continues to be true that the Board's fiscal plans lack a technical and transparent explanation of how these results were reached.

Table 6 Cumulative Effects of Structural Reforms

Fiscal Plans (FP)	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
FP 2018 April	0.55	1.55	1.8	1.8			
FP 2018 June	0.55	1.1	1.1	1.25			
FP 2018 Oct	0.55	0.95	0.95	0.95			
FP 2019		0.1	0.4	0.7	0.7	0.85	
FP 2020			0.1	0.3	0.5	0.6	0.75
FP 2021, 2022 & 2023				0.1	0.2	0.55	0.75

Source: M. Guzmán and D. Santamaría (2023) Overview of Puerto Rico's fiscal, debt and growth policies. (paper unpublished by Espacios Abiertos, University of Yale Presentation Forum)



Graph 6

One-Size-Fits-All Prescriptions Addressed by Structural Reform

Jonathan D. Ostry, Prakash Loungani and Davide Furceri, in *Neoliberalism: Oversold?*, stated with regard to such neoliberalism: "Instead of delivering growth, some neoliberal policies have increased inequality, in turn, jeopardizing durable expansion."¹¹ For instance, the capital flow liberalization has provoked additional crisis.

Since 1980, there have been about 150 episodes of surges in capital inflows in more than 50 emerging market economies; [...] about 20 percent of the time, these episodes end in a financial crisis, and many of these crises are associated with large output declines. Furthermore, according to a paper cited by Furceri and Loungani

¹¹ Jonathan D. Ostry, Prakash Loungani and Davide Furceri, *Neoliberalism: Oversold?* Finance & Development, International Monetary Fund (June 2016).

(2015), the effects of such financial openness on inequality are much higher when a crash ensues.¹² (citations and quotation marks omitted).

The other issue addressed is fiscal austerity. The authors stated:

Austerity policies not only generate substantial welfare costs due to supply-side channels, they also hurt demand—and thus worsen employment and unemployment. The notion that fiscal consolidations can be expansionary (that is, raise output and employment), in part by raising private sector confidence and investment, has been championed by, among others, Harvard economist Alberto Alesina, in the academic world, and by former European Central Bank President Jean-Claude Trichet, in the policy arena. However, in practice, episodes of fiscal consolidation have been followed, on average, by drops rather than by expansions in output.¹³ (emphasis added).

The authors raised overwhelming results: (a) “the benefits of some policies that are an important part of the neoliberal agenda appear to have been somewhat overplayed;”¹⁴ (b) “the case of fiscal consolidation, the short-run costs in terms of lower output and welfare and higher unemployment have been underplayed, and the desirability for countries with ample fiscal space of simply living with high debt and allowing debt ratios to decline organically through growth is underappreciated.”¹⁵

Final Words About the Structural Reforms (SR)

1. SRs have historically centered on independent countries capable of pursuing fully institutional financial and economic power and, ultimately, a decision-making process, with little influence from external institutions. SR have been endorsed and pursued by the WB, along with IMF adjustment policies. The recipe leads to fiscal, financial, and economic trouble.
2. There is a clear-cut distinction between cyclical and structural problems. The latter are those economic problems concerning total-factor productivity and the path of long-term potential growth and development.

¹² *Ibid.*

¹³ *Ibid.*

¹⁴ *Ibid.*

¹⁵ *Ibid.*

3. Established in the late 1940's, the IMF is the institution in charge of maintaining international macroeconomic stability during short-term payment imbalances. The WB's role has been planned adjustment lending, limiting itself to giving advice on macroeconomic policies.
4. Since the late 1970's, the United States has been a principal force in imposing structural adjustment programs (SAPs) on the governments of the global South (Welsh 2005).¹⁶ Such reforms seem to be more ideologically centered than economically based, concerning distribution.
5. According to a group of well-known economists, the European Union and Central Asia have been experiencing secular stagnation.¹⁷ In an era of secular stagnation, this has become a major concern in Europe and Central Asia, as growth has been stagnating, mainly because growth in advanced economies has been subdued.
6. As a result of weaker than expected activity in the European Union, the pace of growth in the region's developing countries has also decelerated and has not yet fully recovered from the slowdown that followed the global financial crisis, which reveals the weakness of the underlying structural bases.
7. Furthermore, the forecast points to further deceleration—more pronounced in Central Europe and the Baltics, due, not only to the tight connections with European Union economies, but also to the region's own worsening demographic trends and minimal growth in productivity and investments.¹⁸
8. Puerto Rico is a territory of the U.S. with no power to pursue an endogenous economic policy, as opposed to many independent countries within a framework of integration. Even the FOMB was a direct imposition of Congress, with little influence from the local government and legislature. Puerto Rico lacks economic sovereignty. The dollar is its currency. federal regulators oversee

¹⁶ Carol Welch, Structural Adjustment Programs & Poverty Reduction Strategy, Institute for Policy Studies https://ips-dc.org/structural_adjustment_programs_poverty_reduction_strategy/ (October 12, 2005).

¹⁷ Lawrence H. Summers, Accepting the Reality of Secular Stagnation, <https://www.imf.org/en/Publications/fandd/issues/2020/03/larry-summers-on-secular-stagnation> (March 2020)

¹⁸ Welch, *op. cit.*

its businesses. federal laws dictate its trade policy. Residents of Puerto Rico pay most federal taxes. This amounted to \$3.6 billion dollars in 2016. However, Puerto Ricans generally do not pay federal income tax, and they continue to enjoy the tax exemptions that have historically incentivized outside investment.

9. SRs are more ideological than economical. They are biased toward free-market and *laissez faire* recipes, undermining government influence on fiscal, monetary, and public-enterprise management decisions.
10. SR policies required strongly shaped government institutions that had previously enhanced and built an efficient market with strong support for growth and equity.
11. SRs have been focused on a GDP/GNP-measuring framework. Therefore, they have mainly relied on growth/non-growth assessments. Considerations of welfare measures, such as the Index of Sustainable and Economic Welfare, Genuine Economic Progress, etc., are not accounted for. These measures indicate increases in welfare and equity, rather than blind-senseless GDP growth.
12. The FOMB has welcomed SR in the fiscal and financial crisis of the Commonwealth, with no other scientific methodology to understand the crisis systematically. SR are not, and have never been, a **cure-for-all** remedy.

The Appropriate Paradigm: Secular Stagnation for the Economy of Puerto Rico.

“But, whereas business-cycle theory treats depression as a temporary, though recurring phenomenon, the theory of secular stagnation brings out the possibility that depression may become the normal condition of the economy.”¹⁹

The Macroeconomic Framework of Secular Stagnation.

Traditional macroeconomics books ordinarily portray that aggregate economic activity experiences recurring hikes and downswings. Business cycles have recurrent, but non-periodic,

¹⁹ Harris, Seymour E. (1943). (1897-1974) (Harvard, A.B., 1920; Ph. D., 1926), former Littauer Professor of Political Economy at Harvard. Cited in *Postwar Economic Problems*. New York, London, McGraw Hill Book Co., p. 67-82, Chapter IV - Secular Stagnation by Alan Sweezy.

patterns. These macroeconomic fluctuations are built-in features of the capitalist system but are also explained by the dynamic nature of changes in population, ageing, consumption, investment, innovation technology, among other factors. A recession or depression is a temporary phenomenon. It only momentarily interrupts the road to economic prosperity. With such an ordinary economic approach, the recovery (expansion) of economic activity is always a given. The only concern is how to identify the expansive factor, or combination of factors, that triggers progressive variables. This, in turn, is helped by an array of tools pursuant to the country's monetary and fiscal policies.

Nowadays, there are three prominent concepts under the more recent macroeconomic approach: the business cycle, balance-sheet recession, and secular stagnation. Some economists argue that the recovery of the European economy is not only slow and fragile due to the presence of a financial cycle and balance-sheet-recession effects, but also due to stagnation in economic growth, accompanied by strong deflationary trends.

Secular stagnation is a thesis contrary to the traditional view of economic cycles, to some extent, because it is part of the theory of complex systems. Secular stagnation conforms to contemporary currents of the theory of complex systems or Economics of Complexity. Within this paradigm, the explosion of unpredictable economic shocks proved to be impossible to resolve, or reduce, through the classical and neo-classical theory. Under the secular-stagnation thesis, economic factors are combined into an intricate network of mechanisms that make crisis complex, and at the same time, extend it throughout perverse dynamics that render the monetary and fiscal policies of traditional macroeconomics unsuccessful. It is the inability to move toward a steady state of growth or achieving macroeconomics potentially. Thus, secular stagnation refers to "a condition of negligible, or no economic, growth in a market-based economy."²⁰

Below is the checklist to determine the existence of secular stagnation:

1. Rising saving rate in the economy from domestic or external sources;

²⁰ Summer, *op. cit.*

2. Massive decline in investment rate due to the lack of attractive gainful opportunities;
3. Autonomous slowing of population growth due to lower fertility rate and high outflow migration;
4. Increasing longevity that induces lower savings rate due to life cycle pattern;
5. Under-consumption trend attributable to functional inequality of income distribution;
[Deceleration of real consumption]
6. Declining trend in the value of capital goods [property values];
7. The insensitivity of economic growth to technological innovation due to its proper range of adaptation or range of applicability;
8. Shrinking of the economic scale and scope; and,
9. Lower long-run trend of real sustainable economic growth.

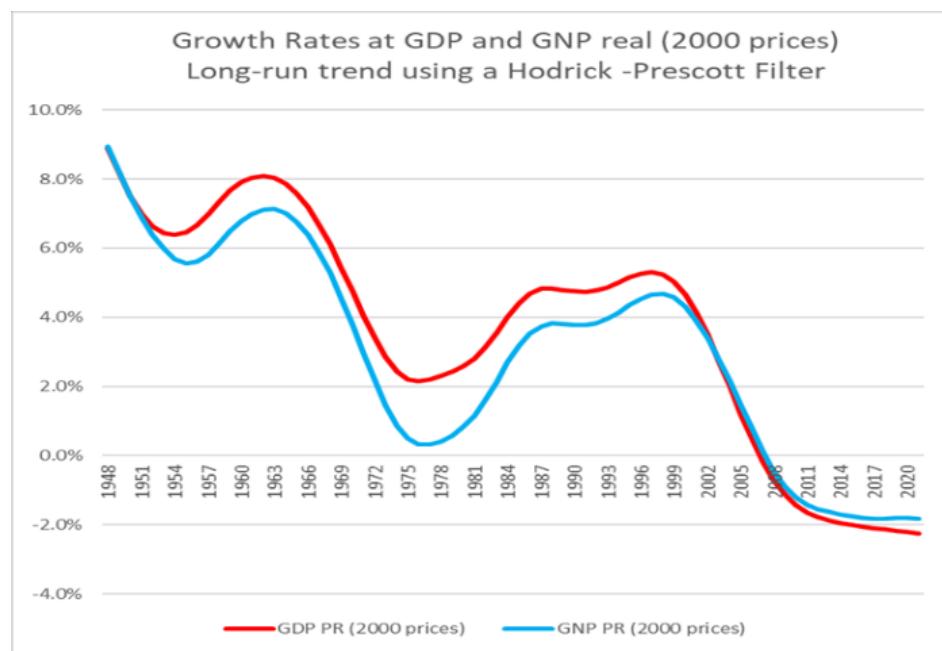
The hypothesis of secular stagnation arose contemporaneously through the intervention of economist and former Harvard University President Lawrence Summers, quoting the original concept established by economist Alvin Hansen in the 1930s. At the end of the 1930s, the economy of the United States and other developed nations underwent slow population growth, coupled with the absence of technological innovation. Thus, developed economies were experiencing prolonged stagnation and did not have a clear path to recovery on the horizon. However, the post-Second World-War boom invigorated the level of investment and technological innovation, which led to recurring, strong prosperity through to the onset of the great recession in 2007.

An important element of the secular-stagnation analysis is to assess the long-term trend. It is well-known that time series contain three components: a) a secular trend; b) cyclical movements; and c) a seasonal component. The secular-trend component is indicative of the economy's potential capacity for long-term movement, and it can be adjusted to assess secular stagnation, if it exists. The secular trend underlying structural factors, such as changes in productivity, changes in demographic circumstances, consumption patterns, institutional framework, and flexibility, among others. This

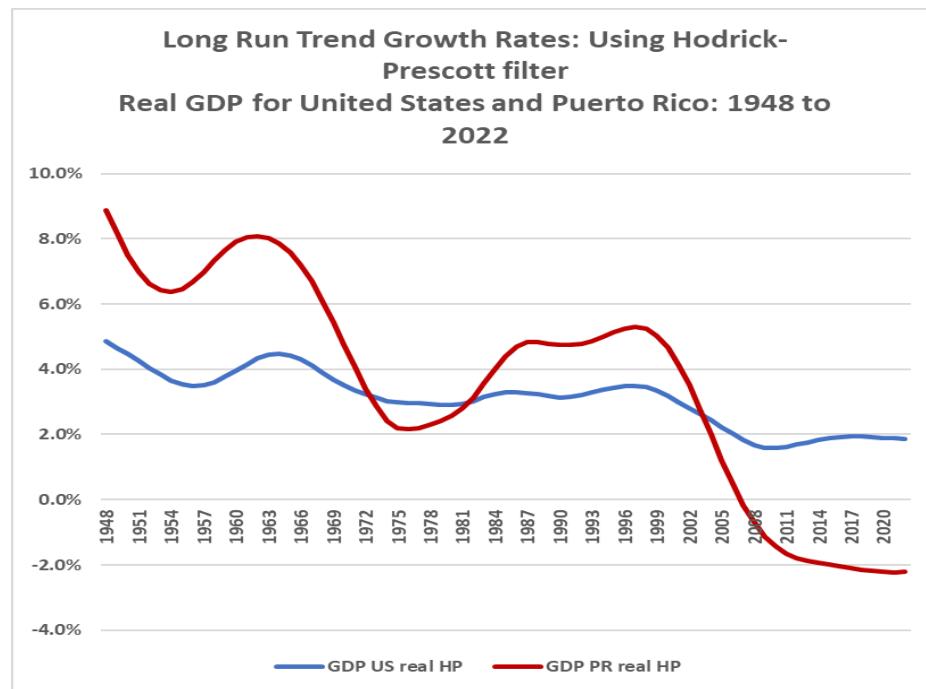
component includes the underlying strength that the local economy has for long-term sustainable recovery.

Graphs 7 and 8 show the secular trend of the real GNP growth in Puerto Rico and the United States, from 1948 to 2022. **Graph 7** depicts the trend of long-term growth in Puerto Rico, using the Hodrick-Prescott filter. You can see that both the real-GNP-growth trend and the real-GDP-growth trend between 1948 and 1975 was between 2% and 8% annually. Between 1975 and 2005, it was between 2% and 5%. However, from 2006 onward, it was negative. This indicates that the positive growth of 1% to 2% presented by the Commonwealth and its officers are not sustainable and are, to a great extent, the result of an influx of federal funds. There is no evidence of sustained recovery, to the extent that the long-term trend does not demonstrate it. **Graph 7 illustrates that Puerto Rico's long-term growth is -2%; while the United States economy is between 1% and 2%.**

Moreover, in **Graph 8**, we compare the long-term growth trend in Puerto Rico and the United States. You can see that the United States is experiencing a declining growth trend. It drops from 4% to below 2%, but it continues to be on a positive trajectory. Puerto Rico, on the other hand, has not been experiencing a positive trajectory, but a negative trajectory, since 2016.



Graph 7



Graph 8

The Economy of Sustainable Energy and its Effects on Long-Term Economic Growth.

Energy as the Engine of Development and Growth

Energy is a vital part of a country's sustained growth. The system must have technical attributes of resilience, effectiveness, operational productivity, advanced technology, generalized accessibility and a relatively low cost, comparable to the people's purchasing power. The energy system must be considered a provider of an essential service and a human right at the same time. Furthermore, energy has occupied an important place in the debate about business competitiveness. Thus, industrial policy considers energy costs to be very relevant, just as any factor that disproportionately increases the burden of production costs and has harmful effects on the competitiveness of industry and commerce. It is also relevant to the welfare of families in terms of their consumption burden.

The Importance of PREPA

In Puerto Rico, the supply model of electrical energy services relies entirely on PREPA. Up until 2021, PREPA was a publicly owned monopoly, but with some components of cogeneration associated

with private companies. Today, two PPPs have been integrated to privatize the operation management of PREPA's two main components: the Transmission and Distribution System and the Legacy Generation Assets. These private companies are *LUMA Energy* and *GeneraPR*. It is important to recognize that PREPA is a high value asset and attractive investment prospect for any foreign or local private company. According to The American Public Power Association (APPA),²¹ among, about 2,000 public utilities in the United States, PREPA has the following rankings:

- Total Generation (2020) Net Megawatts: 11,324,336 Rank number 8:
- Total Electric Revenues (2020) Net Megawatts: \$3,233,430 Rank number 4:
- Total Customers (2020): 1,477,167 Rank number 1:
- Total Sales (2020) Megawatts-hours: 16,035,294 Rank number 9:

An Unsustainable PREPA

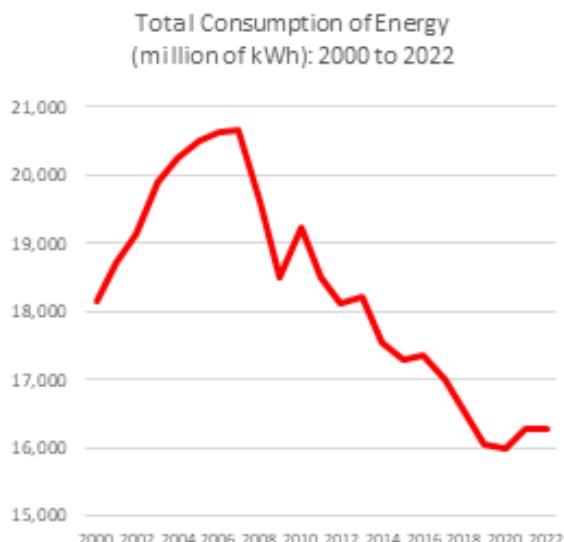
Graphs 9 and 10 show PREPA's total revenues, the average kWh cost, and the consumption of electrical energy in Puerto Rico. This shows that PREPA has been faced with a demand for energy that has been shrinking since 2006 ("peak year of local long-lasting stagnation"), while PREPA's revenues experience ups and downs associated with the cost of the kWh. These graphs suggest that for PREPA to have greater revenues, the determining factor is to increase kWh costs for the industrial, commercial, and residential sectors, because kWh consumption is not a determining factor to obtain greater revenues. Nevertheless, a greater kWh cost leads to lower consumption through three effects: a) the price effect (law of demand); b) the replacement effect (switching to renewable energy); and c) the energy conservation effect (more energy-saving equipment). Even in a hypothetical framework where PREPA is able to reduce the cost of the kWh, its revenues will be lower, because there is no forecast whatsoever that supports an increase in energy consumption, quite the contrary.

²¹ See 2022 PUBLIC POWER STATISTICAL REPORT, <https://www.publicpower.org/resource/public-power-statistical-report>.

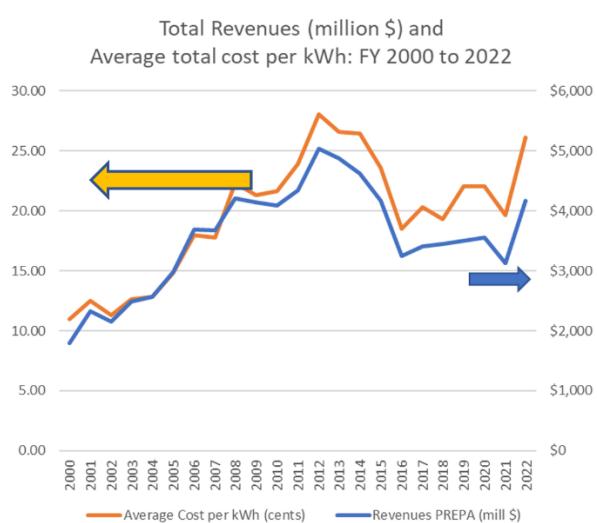
The problem that this distinction in PREPA leads to is that over the past 16 years, during which the demand for electrical energy has been shrinking constantly, PREPA has assumed, and will assume, responsibilities that commit PREPA revenues, which didn't used to exist, such as:

1. LUMA Energy LLC: Operational Fees, Incentives, Pass-Through Expenditures, and Inflation Adjustment.
2. GeneraPR LLC: Operational Fees, Incentives, and Pass-Through Expenditures.
3. Restructured debt servicing.

The two PPPs—LUMA and GeneraPR—did not release PREPA from any costs and expenses. PREPA has to pay fixed fees for the operations of these PPPs and all of their expenses in the passthrough expenditures. These PPPs do not contribute capital investment or pay for operational expenses. They are managers of the operations, and they charge for that.

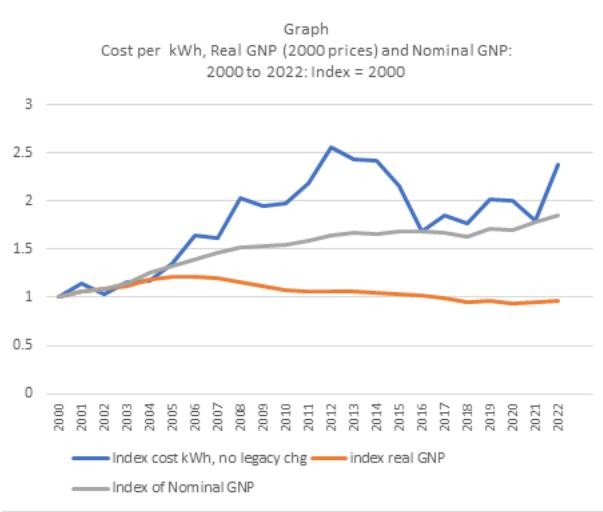


Graph 9



Graph 10

Moreover, well-known Citigroup investment banker David Brownstein clearly stated before the Title III Court that increases in the kWh cost rising quicker than the (real or nominal) economic growth rate are not acceptable for Puerto Rico's economy.²² Puerto Rico's economy must recover sustainably, so that economic activity in and of itself will allow higher kWh costs to be withstood. **Graph 11** presents three indexes of growth: 1) the cost of the kWh, 2) nominal GNP, and 3) real GNP (2000 prices). It demonstrates that between 2000 and 2022, the cost of the kWh underwent greater increases than both the nominal GNP and the real GNP.



Graph 11

²² Case No. 17-03283-LTS, Doc #7816, Brownstein Declaration. DECLARATION OF DAVID BROWNSTEIN IN SUPPORT OF JOINT MOTION OF PUERTO RICO ELECTRIC POWER AUTHORITY AND AAFAF PURSUANT TO BANKRUPTCY CODE SECTIONS 362, 502, 922, AND 928, AND BANKRUPTCY RULES 3012(A)(1) AND 9019 FOR ORDER APPROVING SETTLEMENTS EMBODIED IN THE RESTRUCTURING SUPPORT AGREEMENT

The Critical Threshold of the Cost of the kWh

In this section, I will evaluate what is referred to as the critical or threshold cost of the kWh, which is the value of the cost that makes a country's economic growth become negative. I will refer to this value as the **threshold cost**. To that effect, we must acknowledge that this value will be different for each country, and that it would be inappropriate to extrapolate the same to other countries.

The **threshold cost** is determined through ideal and objective statistical methods, so that the researcher's value judgment does not intervene in such determination. In turn, it is analyzed through the concept of separation from other factors that affect the growth rate in the short- and the medium-term, such as, for example, federal funds, internal fixed-capital investment, exportation levels, among other factors that can affect economic growth. In other words, the Latin phrase commonly used in economics, *ceteris paribus*, is used here. This refers to other factors that are constant or excluded from the analysis. Such threshold-cost analysis reveals the weight that the particular factor exclusively has on growth, excluding from consideration any other factors that affect growth.

The pioneers in this type of estimate-simulation were economists Julio C. Hernández and Wilfredo Toledo (2014), who concluded, and I quote: "you can see how Puerto Rico's real GNP shrinks after the price of the kilowatt hour reaches the **threshold of \$0.12**. This could imply that the country's economic structure has experienced problems when it has been faced with prices higher than this one."²³ (emphasis added)(our translation). The authors add that "the local electrical system, the changes associated with the bankruptcy, and the restructuring of PREPA's debt, do not seem to consider kWh costs lower than this threshold of \$0.12 per kWh hour. The price (cost) of the kWh is higher than \$0.22 per kWh, and there is no indication that this cost will be reduced in the foreseeable future."²⁴ (emphasis added)(our translation).

²³ *Economía de Puerto Rico: El efecto del precio del kilovatio hora en la economía de Puerto Rico* [Puerto Rico's Economy: The Effect of the Price of the Kilowatt Hour on the Economy of Puerto Rico. Julio C. Hernández Correa, Ph.D. and Wilfredo Toledo, Ph.D. August 2014, Volume II, No. 5. Economic Summary of Puerto Rico. Planning Board, https://www.researchgate.net/publication/330507798_El_efecto_del_precio_del_kilovatio hora_en_la_economia_de_Puerto_Rico.

²⁴ *Ibid.*

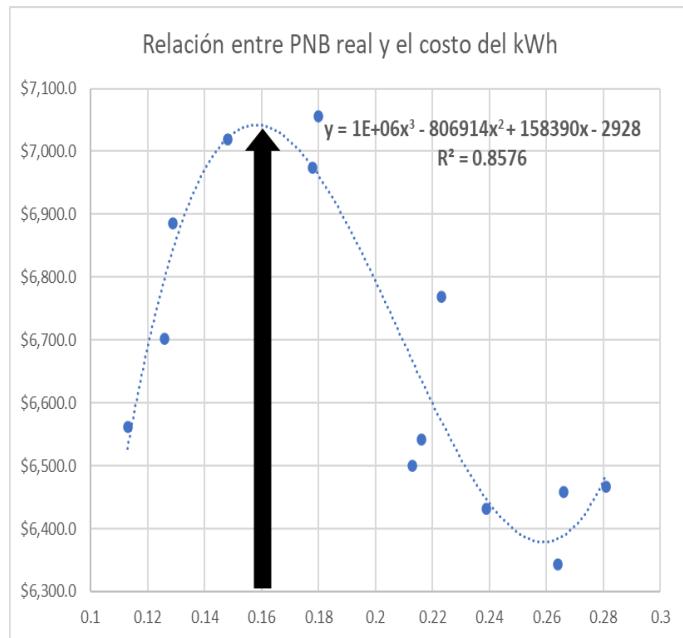
Moreover, the economist hired by the FOMB, Andrew Wolfe, in his sworn declaration before the Title III Court, argued the following, and I quote:

I analyzed what the impact on real economic growth would be if the automatic stay is lifted, a receiver is appointed, and PREPA's electricity rates are increased. As set out in its Fiscal Plan, PREPA's current rate is \$0.198 per kilowatt-hour ("kWh"). I concluded that raising PREPA's blended rate to anything over \$0.214 per kWh (that is, any increase in excess of \$0.016 per kWh to the current rate) would greatly increase the risk of reducing economic growth below the minimum amount of real economic growth necessary for Puerto Rico to achieve fiscal and debt sustainability.²⁵ (emphasis added).

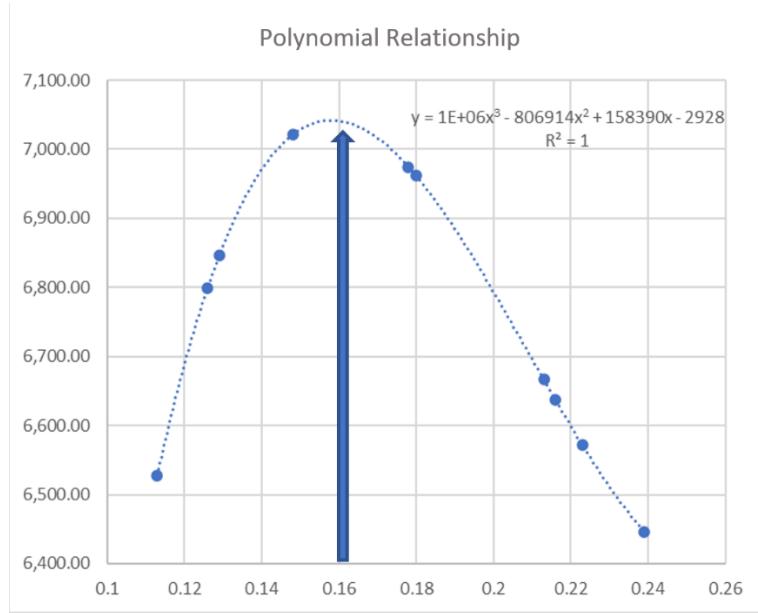
Therefore, Wolfe argued that the critical cost is \$0.21.

Upon review of this value, this economist estimates the relationship between the real GNP at 1954 prices and the cost of the kWh between 2010 and 2022. This relationship is established through a third-degree polynomial model, which reveals that the new **threshold cost** is \$0.16 kWh. In this sense, we can establish that a **threshold cost** below \$0.16 per kWh is one that capitalizes Puerto Rico's economy and leads it to positive growth, as opposed to a cost above \$0.16 cents. The **Table** below shows the effects of the cost of the kWh on the real growth of Puerto Rico's economy. For example, a cost of \$0.12 per kWh in itself has an effect on growth of 3.7% , *ceteris paribus*. On the other hand, a cost above the **threshold cost** of \$0.22 cents has an effect of -1.4%, *ceteris paribus*. See **Graphs 12 and 13**.

²⁵ Case No. 17-04780-LTS, Doc#:149-2 Exhibit B Wolfe Declaration. DECLARATION OF ANDREW WOLFE IN SUPPORT OF OPPOSITION OF THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO TO THE MOTION OF THE AD HOC GROUP OF PREPA BONDHOLDERS, et al.



Graph 12



Graph 13

It is clear that there are several conclusions about the threshold cost. However, the four economists cited above recognize its existence. Furthermore, they admit that there is a critical value that jeopardizes the sustainability of Puerto Rico's economy. This is an important issue for this discussion and for the sustainability of Puerto Rico's economy, its businesses, and competitiveness at a local, regional, and international level.

The Interindustry Effect of Energy

Economists Ruiz & Zalacaín were pioneers in producing estimates of total energy requirements for Puerto Rico's economy.²⁶ The total energy requirements were estimated for 53 sectors, using the input-output matrix analysis. This study demonstrated that a large percentage of industries in Puerto Rico can be greatly affected by an increase in the price of energy resources. Moreover, William Ríos Rodríguez shows industries with high local and total energy multipliers, having identified the 25 sectors that are most sensitive to energy consumption.²⁷

- 2120: Mining (except oil and gas)
- 2130: Other Mining Products
- 2211: Electricity and Irrigation Services
- 2213: Water and Sewer Services
- 3113: Sugar and Related Products, Fruit and Vegetable Preserves and Special Foods
- 3130: Textile Products
- 3140: Other Textile Products
- 3241: Oil and Other Related Products
- 3252: Plastic Materials, Resins and Synthetic Fibers
- 3256: Soaps, Detergents and Cleaning Products
- 3261: Plastic Products
- 3310: Metal Products
- 3340: Computer and Electronic Products
- 4840: Land Transport
- 4860: Pipeline Transport
- 4880: Transportation Services
- 4920: Messenger Services
- 4930: Warehouse Services
- 5150: Broadcasting
- 5241: Brokerage Services
- 5413: Engineer and Architect Services
- 5415: Computerized Design and Related Services
- 5417: Scientific Research Services
- 7110: Arts, Sports Spectators
- 7120: Museums, Historical Sites

Ríos Rodriguez finds that 17 of the 25 sectors that are significantly related to electrical energy contain a relatively high production multiplier. This means that if there is a positive stimulus from the energy sector, which is transferred to other industries through a significant increase in their production. Examples of sectors that could have an important effect on production are the Oil Sector (3241) with a multiplier of 2.85; the Plastic Materials, Resins and Fibers Sector (3252) with a multiplier of 2.77; and the Metal Products Sector (3310) with a multiplier of 2.88.

²⁶ Ruiz, A. L., & Zalacaín, F. (1977). Energy and Economic Development in Puerto Rico: An Input-Output Approach. Caribbean Studies, 17(3/4), 115–136, <http://www.jstor.org/stable/25612815>.

²⁷ Ríos-Rodríguez, W. (2019) *Relación entre el consumo energético y el crecimiento económico en Puerto Rico (1976-2017): Análisis econométrico y de insumo-producto* [Relationship Between Energy Consumption and Economic Growth in Puerto Rico (1976-2017): Econometric and Input-Output Analysis]. Master's Degree Thesis, Department of Economics of the UPR, Rio Piedras Campus.

Econometric Procedures

Below, I will present the econometric procedures that allow us to evaluate the sustainability of the economy in the long run, as a result of the implementation of the Legacy Charge. Elasticities are calculated in accordance with kWh cost forecasts for Puerto Rico. These are presented in the Appendix.

The Equation System

This model uses six equations to model the behavior of Puerto Rico's economy, Hacienda revenues and PREPA revenues. The objective is to estimate the elasticities of critical or independent variables and dependent variables, such as the real GNP, energy consumption, net revenues to the General Fund and PREPA's total Revenues. Let us look at **Chart 2**.

Independent Variables (Exogenous)									
Production Function	Human capital		Capital Stock, adj		Energy Consumption (Mill kWh)		Cost per kWh (Cents)		
	Residential	Industrial	Commercial	Residential	Industrial	Commercial	Residential	Industrial	Commercial
Dependent Variable GNP real	X	X		X	X	X			
Demand of Energy									
Dependent Variable Consumption kWh Residential				X			X		
Consumption kWh Industrial					X		X		
Consumption kWh Commercial					X			X	X
Net Revenue Collection									
Net Revenue General Funds								X	X
PREPA Revenues									
Dependent Variable Revenues from PREPA				X	X	X	X	X	X

Chart 2

There are six equations, and each equation is filled with variables that simultaneously intervene in others. In all of these, the trend value is incorporated quadratically and, furthermore, the variables are converted into natural logarithms.

1. Equation 1 is the Cobb-Douglas macroeconomic production function.

2. Equations 2, 3 and 4 measure the behavior of the demand for energy consumption in kWh, which will affect PREPA's gross revenues.
3. Equation 5 is the explanation for net revenues to the general fund, which is used to look at the feasibility of certified fiscal plans and the payment of debt serve and Pay Go Pensions; and
4. Equation 6 models PREPA's gross revenues, with respect to the consumption estimated and forecasted through Equations 2, 3 and 4.

Modeling is necessary to see how the Legacy Charge could affect the real GNP and affect the demand for electrical energy in the residential, industrial, and commercial sectors.

The Legacy Charge affects the cost per kWh because it adds an additional layer to this cost.

We know that the cost per kWh is a result of PREPA's operations, but the Legacy Charge is not. Although the Legacy Charge is not the result of PREPA's operations, it affects residential, commercial, and industrial customers.

Table 7 Legacy Charge in the Plan of Adjustment

Type of Customer	Fixed/Monthly Charge	Basic Charge (up to 500 kWh / Month)	Excess of 500 kWh / Mo.
	Cents x kWh	Cents x kWh	Cents x kWh
Residential			
With Subsidy	\$0	0.00	1.00
Without Subsidy	\$13	0.75	3.00
Commercial			
Small	\$16	1.00	3.00
Medium	\$800	1.45	1.45
Large	\$1,800	0.97	0.97
Industrial			
Small	\$20	2.18	2.18
Medium	\$800	2.18	2.18
Large	\$1,800	1.45	1.45
Government			
GSS 211	\$20	1.45	2.90
GSP	\$800	1.45	1.45
GST	\$1,800	0.97	0.97

The Logic of Causal-Effect relationships

The econometric estimate of these six equations allows us to estimate the particular elasticities of the related variables, which will allow us to have estimates of the ultimate effects of this **Legacy Charge over a 30-year period**. **Chart 3** presents the causal logic between mechanisms,

technological and economic relations, and variables to be potentially affected. An increase in electricity rates increases the retail price of electricity for the various sectors, leading to a lower demand in kWh. This can be due to the price effect, replacement effect or energy conservation effect. Such lower demand affects the level of the real GNP and PREPA's revenues. The reduction of the real GNP is, in turn, affected by the shrinking population and the effect of a lower demand for energy. The ultimate effect falls upon net revenues to the General Fund.

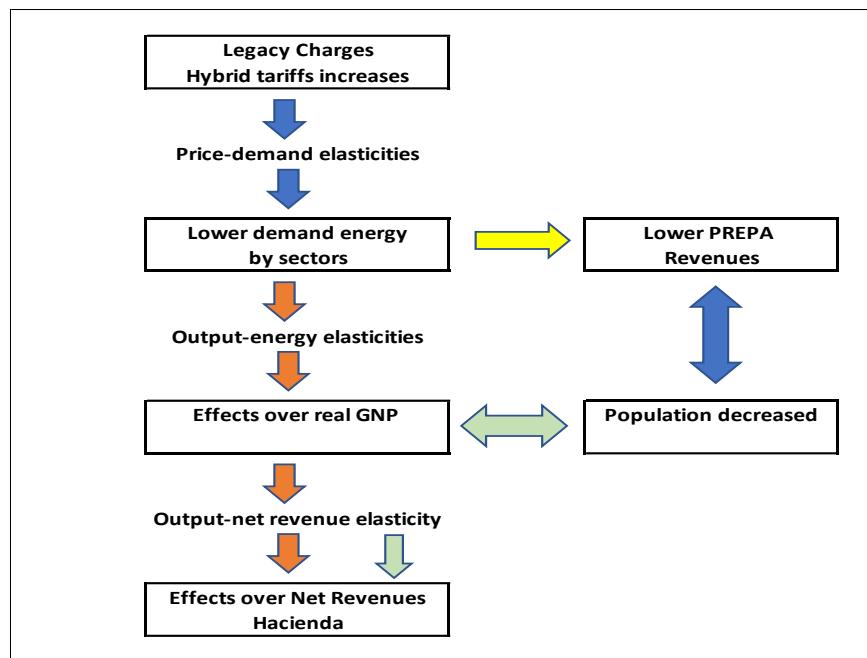


Chart 3

In all of these, I used the concept of elasticities. The elasticity between variable X and variable Y is the change in percentage in variable Y, due to a change of 1% in variable X. For example, if elasticity is 2.00, this implies that a 1% change in variable X generates a 2% change in variable Y. The direction that the changes move in is recognized by the sign of the elasticity coefficient, whether it is negative or positive. If it is positive, both variables, X and Y, move together. If it is negative, they move in opposite directions. The coefficient of elasticity $\epsilon_{x,y}$ is defined as follows:

$$\epsilon_{x,y} = \frac{\Delta\%y}{\Delta\%x}$$

Equation 1 is the Production Function.

$$Q = f(H^\alpha, K^\mu, Er^\pi, Ei^\phi, Ec^\Delta)$$

Where:

Q = real GNP prices 2000, millions of dollars.

H = Human capital of Puerto Rico; yearly employment times labor augmented by year of schooling and life expectancy.

K = Capital Stock, adjusted using the U.S. rate of utilization. Estimated by the perpetual inventory equation.

Er = Consumption of kWh, millions of kWh, residential sector.

Ei = Consumption of kWh, millions of kWh, industrial sector.

Ec = Consumption of kWh, millions of kWh, commercial sector.

α , μ , π , ϕ y Δ are the coefficients of elasticities, once the equation is converted to logarithms.

Equations 2, 3 and 4 are the equation for kWh demand in the residential, industrial and commercial sectors, respectively.

$$DkWh = f(CostkWh^\alpha, Customers^\sigma, real GNP^\psi)$$

Where:

DkWh = Consumption of kWh, millions of kWh; residential, industrial, and commercial.

CostkWh = Cents per kWh.

Customers = Number of PREPA customers.

Real GNP = Gross National Product, 2000 prices, millions of dollars.

α , σ and ψ are elasticity values, when equations were converted into logarithm values.

Equation 5 is the Net Revenue Collection of General Funds.

$$NRGF = f(Real\ GNP^\alpha, \ Population^\sigma)$$

Where:

NRGF = Net Revenue to General Funds, million current dollars.

Real Personal Consumption = Real GNP, millions of 2000 prices.

Population = Population in Puerto Rico.

α, σ are elasticities of NRGF with respect to each independent variable.

Equation 6 is:

$$RPREPA = f(CostkWh^\alpha, \ Customers^\sigma, \ real\ GNP^\psi)$$

Where:

RPREPA= Revenues of PREPA, millions of dollars.

CostkWh = cents per kWh.

Customers = Customers of PREPA.

Real GNP = Real Gross National Product, 2000 prices.

α, σ, ψ are elasticities of PREPA Revenues with respect to each independent variable.

It is of paramount importance to realize that all six equations were tested and run under diverse combinations to provide the best fitted models and parameters. We used E-Views software under OLS modifications under co-integration procedures.

Results of Models

Production Function: Equation 1

Dependent Variable: LOG(real GNP, 2000)

Method: Fully Modified Least Squares (FMOLS)

Sample (adjusted): 2001 2022

Cointegrating equation deterministics: C @TREND @TREND^2

Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Independent Vars	K	H	Er	Ec	Ei	Constant	Trend	Trend^2
Coefficient	0.005094	0.299941	0.09136	0.5274	0.10285	1.006948	0.0042	-0.000207
Prob.	0.9528	0.085	0.3483	0.0188	0.42	0.4803	0.5592	0.5804

Italic significant at 5%

R-squared	Adjusted R-squared	S.E. of regression	Long-run variance
0.969048	0.953571	0.01785	0.000151

The elasticities of the real GNP to changes in kWh consumption by sector are:

Residential..... 0.0914 (adjusted by 70% non-exempted customers; 30% exempted).

Commercial 0.5274

Industrial..... 0.1029

The value came from a Fully Modified Cointegration Regression (FMOLS) using E-Views software.

The Demand for Energy by Sector:

Equation 2: Demand for Energy in Residential Sector

Dependent Variable: LOG(DkWh_RESIDENCIAL)

Method: Canonical Cointegrating Regression (CCR)

Sample (adjusted): 2001 2022

Cointegrating equation deterministics: C @TREND @TREND^2

Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

	Customers Residential	CostkWh	Real Personal Consumption	Constant	@TREND	@TREND^2
Coefficient	1.60923	-0.039455	0.581153	-10.89438	-0.03744	0.000825
Prob.	0.0026	0.6001	0.103	0.1641	0.011	0.1264

Italic significant at 5%

R-squared	Adjusted R-squared	S.E. of regression	Long-run variance
0.616429	0.496563	0.042652	0.001032

Equation 3: Demand for Energy in Industrial Sector

Dependent Variable: LOG(DkWh Industrial_MKWH_)
 Method: Canonical Cointegrating Regression (CCR)
 Sample (adjusted): 2001 2022
 Cointegrating equation deterministics: C @TREND @TREND^2
 Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

	CostkWh	Consumption per customer	Real GNP	Constant	@TREND	@TREND^2
Coefficient	-0.044534	-0.122299	1.31439	-5.506696	-2.84E-02	4.36E-05
Prob.	0.43500	0.37160	0.00020	0.08010	0.09840	0.9504
<i>Italic significant at 5%</i>						
R-squared	Adjusted R-squared	S.E. of regression	Long-run variance			
0.985653	0.98117	0.040799	0.000904			

Equation 4: Demand for Energy in Commercial Sector

Dependent Variable: LOG(DkWh COMERCIAL)
 Method: Fully Modified Least Squares (FMOLS)
 Sample (adjusted): 2001 2022
 Cointegrating equation deterministics: C @TREND @TREND^2
 Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

	Customers	CostkWh	Constant	@TREND	@TREND^2
Coefficient	0.876163	-0.031575	-1.260988	0.023523	-0.001152
Prob.	0.0316	0.3873	0.7754	0.0001	0
R-squared	Adjusted R-squared	S.E. of regression	Long-run variance		
0.94195	0.928291	0.01823	0.000346		

The elasticities of energy consumption in kWh in relation to kWh costs (Price-Demand Elasticities)

Residential..... -0.0709 (adjusted to 70%, residential, non-exempted);

Industrial - 0.0728

Commercial -0.3158

Equation 5: General Fund Net Revenue Equation

Dependent Variable: LOG(INGNETFGHP)
Method: Dynamic Least Squares (DOLS)
Cointegrating equation deterministics: C @TREND @TREND^2
Fixed leads and lags specification (lead=1, lag=-1)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

	Real GNP	Population	Constant	@TREND	@TREND^2
Coefficient	0.307496	-0.159099	8.02805	0.003158	0.000731
P Value	0.00	0.13	0.00	0.01	0.00
<i>Italic significant at 5%</i>					
R-squared	Adjusted R-squared	S.E. of regression	Long-run variance		
0.997249	0.996602	0.007066	5.36E-05		

The elasticities of General Fund Net Revenues in Relation to the Real GNP:

Elasticity of General Fund Net Revenues in relation to Real GNP = 0.3075

Equation 6: PREPA Revenues

Dependent Variable: LOG(Revenues PREPA_Mill \$)
Method: Fully Modified Least Squares (FMOLS)
Sample (adjusted): 2001 2022
Cointegrating equation deterministics: C @TREND @TREND^2
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

	CostkWh	ConsumptionKWH	Constant	@TREND	@TREND^2
Coeff.	0.922722	0.821185	-2.681302	0.012995	-0.00053
Prob. V	0.000	0.000	0.0485	0.0131	0.01
<i>Italic significant at 5%</i>					
R-squared	Adjusted R-squared	S.E. of regression	Long-run variance		
0.991546	0.989556	0.024137	0.000361		

The Elasticities of PREPA Revenues are:

Total Consumption..... 0.821185

Total cost per kWh 0.922722

Simulations and scenarios

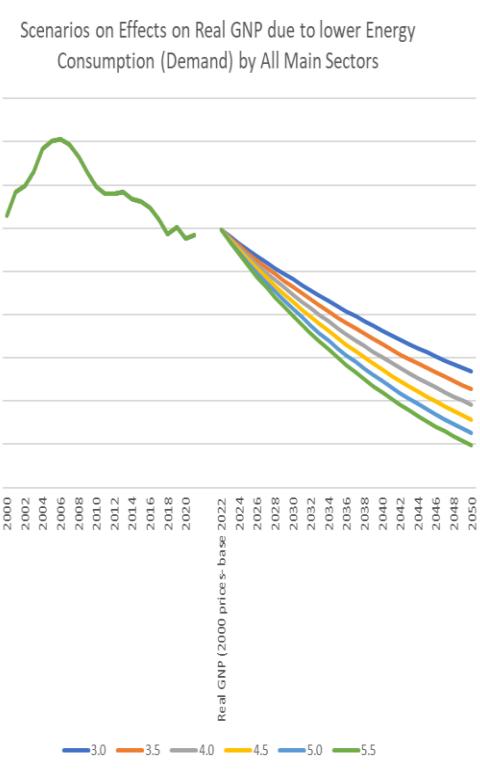
Production Function: Equation 1

The effects of lower energy consumption, due to PREPA's higher rate level (base-forecast) on the real GNP of Puerto Rico; *ceteris paribus*. As we can see, the greater the cost of the kWh, the greater the effects it has on energy consumption. The greater the rate increase represented by the Legacy Charge, the greater the simulation of the real GNP. If the Legacy Charge in general, resulted in an increase of 3 c/kWh, the average annual reduction of the real GNP is -1.53% and the median is -1.44%. On the other hand, if the Legacy Charge resulted in an increase of 5.5 c/kWh, the effect is -2.32 on the annual growth of the Real GNP in Puerto Rico.

Table 8

Level of cost kWh + legacy charges	3.0	3.5	4.0	4.5	5.0	5.5
Real GNP (2000 prices- base 2022)	\$39,820	\$39,820	\$39,820	\$39,820	\$39,820	\$39,820
2023	\$38,979	\$38,839	\$38,699	\$38,558	\$38,418	\$38,278
2024	\$38,233	\$37,972	\$37,711	\$37,452	\$37,193	\$36,935
2025	\$37,486	\$37,106	\$36,729	\$36,354	\$35,982	\$35,613
2026	\$36,768	\$36,277	\$35,791	\$35,309	\$34,833	\$34,361
2027	\$36,071	\$35,475	\$34,887	\$34,306	\$33,733	\$33,168
2028	\$35,393	\$34,697	\$34,012	\$33,339	\$32,676	\$32,025
2029	\$34,730	\$33,938	\$33,162	\$32,401	\$31,655	\$30,924
2030	\$34,078	\$33,195	\$32,333	\$31,489	\$30,666	\$29,861
2031	\$33,438	\$32,468	\$31,523	\$30,602	\$29,706	\$28,832
2032	\$32,809	\$31,756	\$30,732	\$29,739	\$28,774	\$27,838
2033	\$32,189	\$31,055	\$29,957	\$28,895	\$27,867	\$26,873
2034	\$31,579	\$30,368	\$29,200	\$28,074	\$26,987	\$25,939
2035	\$30,980	\$29,696	\$28,462	\$27,275	\$26,134	\$25,037
2036	\$30,395	\$29,042	\$27,745	\$26,503	\$25,312	\$24,171
2037	\$29,823	\$28,404	\$27,049	\$25,754	\$24,518	\$23,337
2038	\$29,260	\$27,779	\$26,368	\$25,025	\$23,746	\$22,529
2039	\$28,712	\$27,172	\$25,710	\$24,322	\$23,005	\$21,755
2040	\$28,172	\$26,576	\$25,066	\$23,636	\$22,284	\$21,006
2041	\$27,643	\$25,993	\$24,437	\$22,970	\$21,586	\$20,282
2042	\$27,125	\$25,426	\$23,827	\$22,325	\$20,913	\$19,586
2043	\$26,620	\$24,873	\$23,236	\$21,702	\$20,264	\$18,918
2044	\$26,127	\$24,336	\$22,662	\$21,099	\$19,638	\$18,275
2045	\$25,644	\$23,811	\$22,104	\$20,514	\$19,034	\$17,656
2046	\$25,173	\$23,301	\$21,562	\$19,948	\$18,451	\$17,061
2047	\$24,713	\$22,803	\$21,036	\$19,401	\$17,888	\$16,489
2048	\$24,263	\$22,320	\$20,526	\$18,872	\$17,346	\$15,939
2049	\$23,826	\$21,850	\$20,033	\$18,361	\$16,825	\$15,412
2050	\$23,397	\$21,391	\$19,552	\$17,866	\$16,320	\$14,904

Level of cost kWh + legacy charges	3.0	3.5	4.0	4.5	5.0	5.5
Rate of Growth-Real GNP forecast						
Average-2023 to 2050 per year	-1.53%	-1.71%	-1.89%	-2.04%	-2.19%	-2.32%
Median - 2023 to 2050 per year	-1.44%	-1.60%	-1.75%	-1.88%	-1.99%	-2.09%



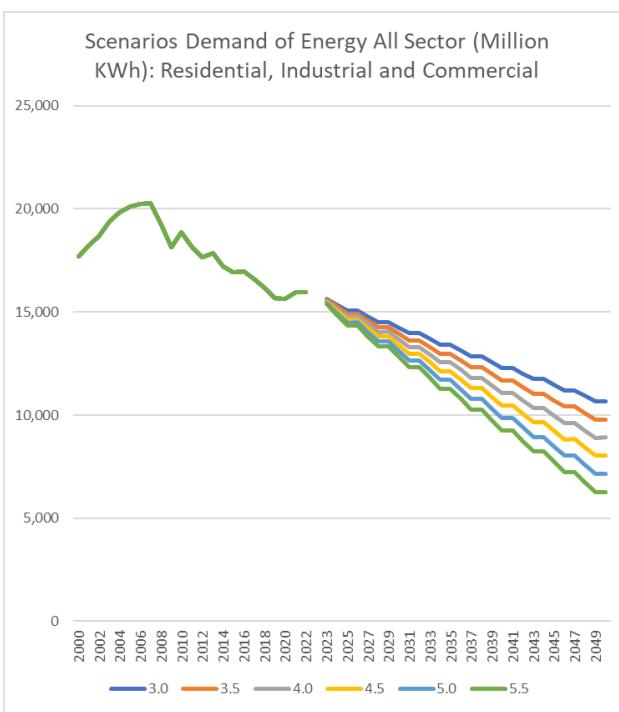
Graph 14

Results Equations 2, 3 and 5

Demand for Energy: All Sectors

Table 9

Year	3.00	3.5	4.0	4.5	5.0	5.5
2023	15,638.1	15,586.2	15,534.3	15,482.3	15,430.4	15,378.5
2024	15,355.9	15,256.9	15,157.9	15,058.9	14,959.9	14,860.9
2025	15,067.7	14,920.7	14,773.7	14,626.7	14,479.7	14,332.7
2026	15,073.2	14,927.1	14,781.0	14,634.9	14,488.8	14,342.7
2027	14,793.7	14,601.0	14,408.3	14,215.7	14,023.0	13,830.3
2028	14,516.4	14,277.5	14,038.6	13,799.8	13,560.9	13,322.0
2029	14,517.1	14,278.3	14,039.6	13,800.8	13,562.0	13,323.2
2030	14,240.4	13,955.6	13,670.7	13,385.8	13,100.9	12,816.0
2031	13,963.4	13,632.3	13,301.2	12,970.2	12,639.1	12,308.0
2032	13,963.0	13,631.9	13,300.8	12,969.6	12,638.5	12,307.4
2033	13,684.0	13,306.3	12,928.7	12,551.1	12,173.4	11,795.8
2034	13,404.5	12,980.3	12,556.1	12,131.9	11,707.6	11,283.4
2035	13,404.0	12,979.7	12,555.5	12,131.2	11,706.9	11,282.6
2036	13,125.6	12,655.0	12,184.3	11,713.6	11,242.9	10,772.2
2037	12,848.0	12,331.1	11,814.1	11,297.1	10,780.2	10,263.2
2038	12,847.3	12,330.2	11,813.1	11,296.0	10,778.9	10,261.8
2039	12,570.9	12,007.8	11,444.7	10,881.5	10,318.4	9,755.2
2040	12,293.7	11,684.4	11,075.0	10,465.7	9,856.3	9,247.0
2041	12,293.7	11,684.4	11,075.1	10,465.7	9,856.4	9,247.1
2042	12,017.6	11,362.3	10,706.9	10,051.5	9,396.2	8,740.8
2043	11,743.0	11,041.9	10,340.8	9,639.7	8,938.6	8,237.4
2044	11,744.3	11,043.4	10,342.5	9,641.6	8,940.7	8,239.8
2045	11,471.7	10,725.4	9,979.1	9,232.7	8,486.4	7,740.0
2046	11,200.7	10,409.2	9,617.7	8,826.2	8,034.6	7,243.1
2047	11,202.0	10,410.7	9,619.4	8,828.1	8,036.8	7,245.5
2048	10,933.8	10,097.8	9,261.9	8,425.9	7,589.9	6,753.9
2049	10,667.8	9,787.5	8,907.2	8,026.9	7,146.5	6,266.2
2050	10,668.4	9,788.2	8,908.0	8,027.8	7,147.5	6,267.3

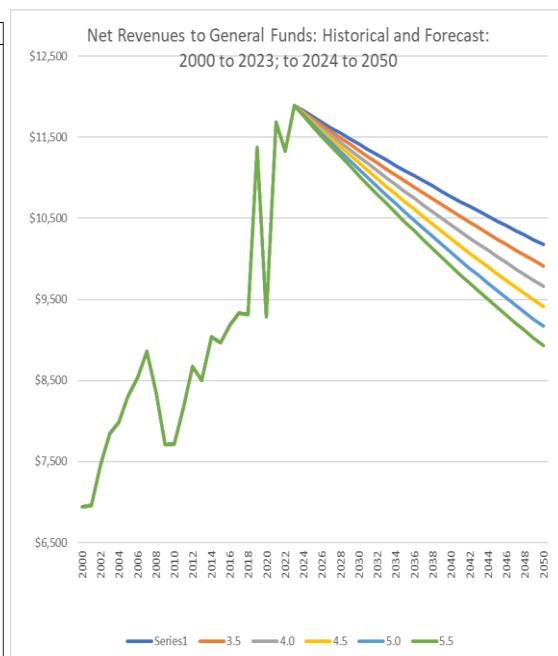


Graph 15

Net Revenues to General Funds

Table 10

Years	3.0	3.5	4.0	4.5	5.0	5.5
2023	\$11,893	\$11,893	\$11,893	\$11,893	\$11,893	\$11,893
2024	\$11,823	\$11,812	\$11,800	\$11,788	\$11,777	\$11,765
2025	\$11,752	\$11,729	\$11,706	\$11,682	\$11,659	\$11,636
2026	\$11,683	\$11,648	\$11,614	\$11,579	\$11,544	\$11,510
2027	\$11,615	\$11,569	\$11,523	\$11,478	\$11,432	\$11,387
2028	\$11,548	\$11,491	\$11,435	\$11,378	\$11,322	\$11,266
2029	\$11,481	\$11,414	\$11,347	\$11,280	\$11,213	\$11,147
2030	\$11,415	\$11,337	\$11,259	\$11,182	\$11,106	\$11,029
2031	\$11,349	\$11,261	\$11,173	\$11,085	\$10,999	\$10,912
2032	\$11,284	\$11,185	\$11,087	\$10,989	\$10,893	\$10,797
2033	\$11,218	\$11,109	\$11,001	\$10,893	\$10,787	\$10,682
2034	\$11,153	\$11,033	\$10,915	\$10,798	\$10,682	\$10,568
2035	\$11,087	\$10,958	\$10,830	\$10,704	\$10,578	\$10,454
2036	\$11,023	\$10,884	\$10,746	\$10,610	\$10,476	\$10,343
2037	\$10,959	\$10,810	\$10,663	\$10,518	\$10,375	\$10,233
2038	\$10,896	\$10,737	\$10,581	\$10,427	\$10,275	\$10,125
2039	\$10,833	\$10,665	\$10,500	\$10,337	\$10,176	\$10,018
2040	\$10,770	\$10,593	\$10,419	\$10,247	\$10,078	\$9,912
2041	\$10,708	\$10,522	\$10,338	\$10,158	\$9,981	\$9,807
2042	\$10,646	\$10,451	\$10,259	\$10,070	\$9,885	\$9,703
2043	\$10,586	\$10,381	\$10,181	\$9,984	\$9,791	\$9,601
2044	\$10,525	\$10,312	\$10,103	\$9,899	\$9,698	\$9,501
2045	\$10,465	\$10,244	\$10,027	\$9,814	\$9,606	\$9,402
2046	\$10,406	\$10,176	\$9,951	\$9,731	\$9,516	\$9,305
2047	\$10,348	\$10,110	\$9,877	\$9,649	\$9,426	\$9,209
2048	\$10,290	\$10,044	\$9,803	\$9,568	\$9,339	\$9,114
2049	\$10,233	\$9,979	\$9,731	\$9,489	\$9,252	\$9,022
2050	\$10,176	\$9,914	\$9,659	\$9,410	\$9,167	\$8,930



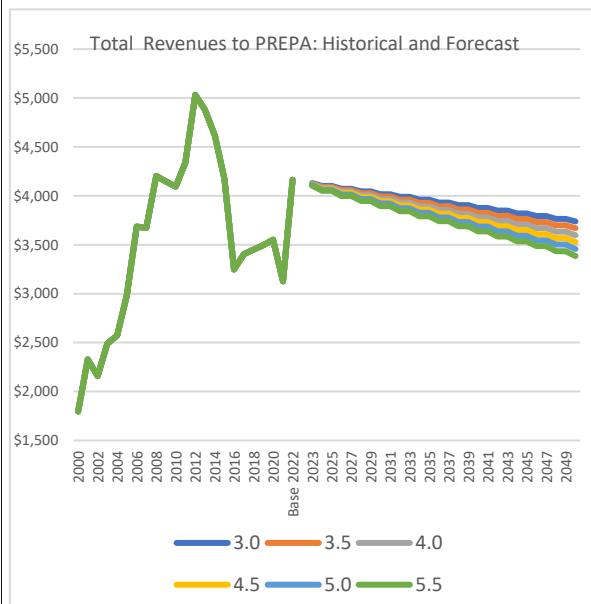
Graph 16

Results

Equation 6: PREPA Revenues

Table 11

Fiscal Years	3.0	3.5	4.0	4.5	5.0	5.5
2023	\$4,131	\$4,126	\$4,120	\$4,115	\$4,110	\$4,105
2024	\$4,102	\$4,092	\$4,082	\$4,072	\$4,062	\$4,052
2025	\$4,102	\$4,092	\$4,081	\$4,071	\$4,061	\$4,051
2026	\$4,073	\$4,058	\$4,043	\$4,028	\$4,013	\$3,998
2027	\$4,073	\$4,058	\$4,044	\$4,029	\$4,014	\$3,999
2028	\$4,045	\$4,026	\$4,006	\$3,986	\$3,967	\$3,947
2029	\$4,045	\$4,026	\$4,006	\$3,987	\$3,967	\$3,947
2030	\$4,017	\$3,993	\$3,969	\$3,944	\$3,920	\$3,896
2031	\$4,017	\$3,993	\$3,969	\$3,944	\$3,920	\$3,896
2032	\$3,989	\$3,960	\$3,931	\$3,902	\$3,873	\$3,844
2033	\$3,989	\$3,960	\$3,931	\$3,902	\$3,873	\$3,844
2034	\$3,960	\$3,927	\$3,893	\$3,859	\$3,826	\$3,792
2035	\$3,960	\$3,927	\$3,893	\$3,859	\$3,826	\$3,792
2036	\$3,932	\$3,894	\$3,855	\$3,817	\$3,778	\$3,740
2037	\$3,932	\$3,894	\$3,855	\$3,817	\$3,779	\$3,740
2038	\$3,904	\$3,861	\$3,818	\$3,775	\$3,731	\$3,688
2039	\$3,904	\$3,861	\$3,818	\$3,775	\$3,732	\$3,689
2040	\$3,876	\$3,828	\$3,780	\$3,733	\$3,685	\$3,637
2041	\$3,876	\$3,828	\$3,780	\$3,733	\$3,685	\$3,637
2042	\$3,848	\$3,795	\$3,743	\$3,691	\$3,638	\$3,586
2043	\$3,848	\$3,796	\$3,743	\$3,691	\$3,638	\$3,586
2044	\$3,820	\$3,763	\$3,706	\$3,649	\$3,592	\$3,535
2045	\$3,820	\$3,763	\$3,706	\$3,649	\$3,592	\$3,535
2046	\$3,793	\$3,731	\$3,670	\$3,608	\$3,546	\$3,485
2047	\$3,793	\$3,731	\$3,670	\$3,608	\$3,547	\$3,485
2048	\$3,766	\$3,700	\$3,634	\$3,567	\$3,501	\$3,435
2049	\$3,766	\$3,700	\$3,634	\$3,568	\$3,502	\$3,436
2050	\$3,739	\$3,668	\$3,598	\$3,527	\$3,457	\$3,386



Graph 17

The Scenario with Estimated Legacy Charges

In this section, I will estimate the equations system, but with a given c/kWh Legacy Charge. The Legacy Charge considered is estimated as follows:

Table 12

Type	Fixed charge	Volumetric	Total Charge
Residential	0.0165	0.0041	0.0205
Commercial	0.0186	0.0158	0.0344
Industrial	0.0039	0.015	0.0189

This Legacy Charge c/kWh is a weighted average arrived at using PREPA's 2021 consumption data for each sector. The results are as follows:

The Effect on the Real GNP

Table 13

FY	Real GNP	FY	Real GNP Forecast
2000	\$41,419	2024	\$38,039
2001	\$44,169	2025	\$37,204
2002	\$44,862	2026	\$36,403
2003	\$46,521	2027	\$35,628
2004	\$49,142	2028	\$34,876
2005	\$50,076	2029	\$34,141
2006	\$50,322	2030	\$33,421
2007	\$49,713	2031	\$32,716
2008	\$48,259	2032	\$32,025
2009	\$46,445	2033	\$31,344
2010	\$44,785	2034	\$30,677
2011	\$44,031	2035	\$30,022
2012	\$44,031	2036	\$29,386
2013	\$44,207	2037	\$28,764
2014	\$43,429	2038	\$28,154
2015	\$43,075	2039	\$27,562
2016	\$42,389	2040	\$26,980
2017	\$41,020	2041	\$26,410
2018	\$39,277	2042	\$25,854
2019	\$40,114	2043	\$25,314
2020	\$38,834	2044	\$24,787
2021	\$39,232	2045	\$24,272
2022	\$39,820	2046	\$23,771
2023	\$38,875	2047	\$23,282
		2048	\$22,807
		2049	\$22,345
		2050	\$21,893

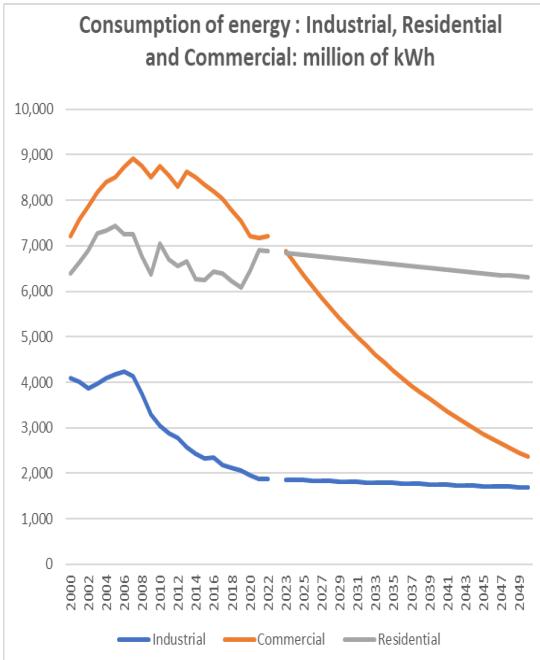


Graph 18

The Effect on the Demand for Energy

Table 14

Consumption kWh (million kWh)				
Fiscal Years	Industrial	Commercial	Residential	All Sum
2023	1,862	6,890	6,851	15,603
2024	1,855	6,617	6,829	15,301
2025	1,848	6,349	6,807	15,004
2026	1,841	6,096	6,786	14,724
2027	1,835	5,857	6,765	14,456
2028	1,828	5,628	6,744	14,201
2029	1,822	5,410	6,723	13,954
2030	1,816	5,199	6,702	13,717
2031	1,809	4,997	6,681	13,487
2032	1,803	4,802	6,661	13,265
2033	1,796	4,613	6,640	13,049
2034	1,790	4,432	6,619	12,841
2035	1,784	4,258	6,598	12,639
2036	1,777	4,091	6,578	12,446
2037	1,771	3,931	6,557	12,260
2038	1,765	3,777	6,537	12,079
2039	1,758	3,631	6,517	11,906
2040	1,752	3,489	6,497	11,738
2041	1,746	3,353	6,477	11,576
2042	1,740	3,223	6,457	11,419
2043	1,734	3,099	6,437	11,269
2044	1,728	2,980	6,417	11,124
2045	1,722	2,865	6,398	10,985
2046	1,716	2,756	6,378	10,850
2047	1,710	2,652	6,359	10,720
2048	1,704	2,552	6,340	10,596
2049	1,698	2,456	6,321	10,476
2050	1,692	2,365	6,302	10,359

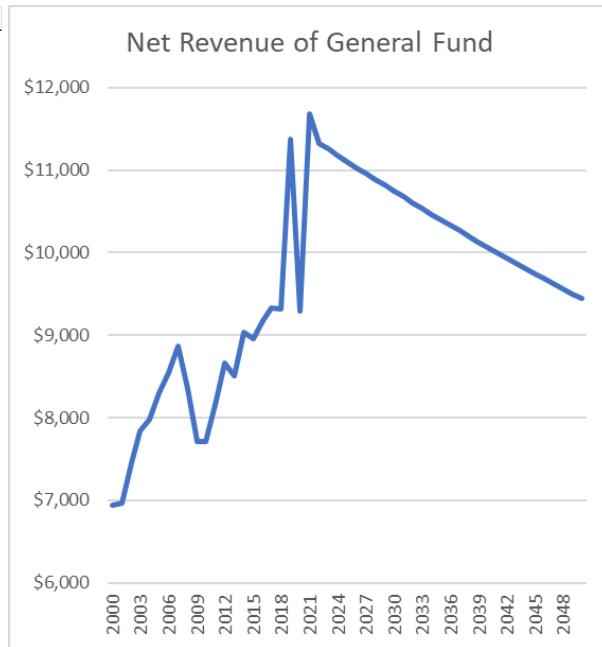


Graph 19

The Effect on Net Revenues to General Fund

Table 15

FY	Net Revenue to GF	FY	Net Revenue to GF
2000	\$6,944	2024	\$11,178
2001	\$6,962	2025	\$11,102
2002	\$7,454	2026	\$11,029
2003	\$7,842	2027	\$10,957
2004	\$7,995	2028	\$10,885
2005	\$8,306	2029	\$10,815
2006	\$8,541	2030	\$10,745
2007	\$8,863	2031	\$10,675
2008	\$8,359	2032	\$10,606
2009	\$7,710	2033	\$10,536
2010	\$7,716	2034	\$10,467
2011	\$8,158	2035	\$10,399
2012	\$8,667	2036	\$10,331
2013	\$8,502	2037	\$10,264
2014	\$9,037	2038	\$10,197
2015	\$8,961	2039	\$10,131
2016	\$9,175	2040	\$10,065
2017	\$9,335	2041	\$10,000
2018	\$9,313	2042	\$9,935
2019	\$11,376	2043	\$9,871
2020	\$9,289	2044	\$9,808
2021	\$11,688	2045	\$9,745
2022	\$11,327	2046	\$9,683
2023	\$11,252	2047	\$9,622
		2048	\$9,562
		2049	\$9,502
		2050	\$9,443

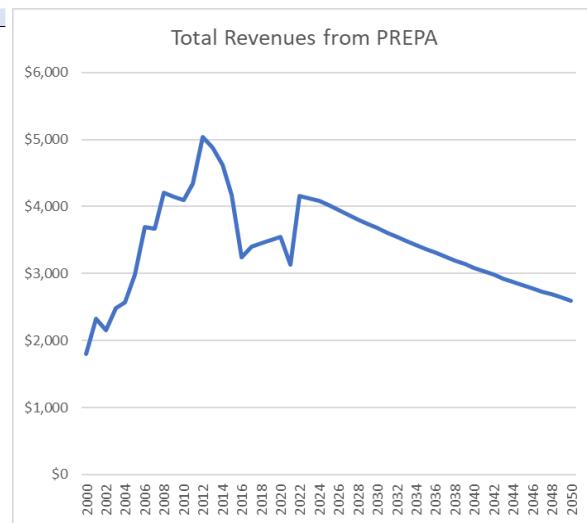


Graph 20

The Effect on PREPA Revenues

Table 16

FY	Revenues PREPA	FY	Revenues PREPA
2000	\$1,796	2024	\$4,089
2001	\$2,329	2025	\$4,017
2002	\$2,159	2026	\$3,944
2003	\$2,489	2027	\$3,875
2004	\$2,572	2028	\$3,807
2005	\$2,982	2029	\$3,741
2006	\$3,687	2030	\$3,676
2007	\$3,672	2031	\$3,613
2008	\$4,202	2032	\$3,550
2009	\$4,146	2033	\$3,488
2010	\$4,093	2034	\$3,428
2011	\$4,339	2035	\$3,368
2012	\$5,033	2036	\$3,309
2013	\$4,880	2037	\$3,251
2014	\$4,619	2038	\$3,195
2015	\$4,174	2039	\$3,139
2016	\$3,246	2040	\$3,085
2017	\$3,403	2041	\$3,031
2018	\$3,450	2042	\$2,979
2019	\$3,498	2043	\$2,927
2020	\$3,551	2044	\$2,877
2021	\$3,128	2045	\$2,828
2022	\$4,163	2046	\$2,779
2023	\$4,123	2047	\$2,732
		2048	\$2,686
		2049	\$2,641
		2050	\$2,597



Graph 21

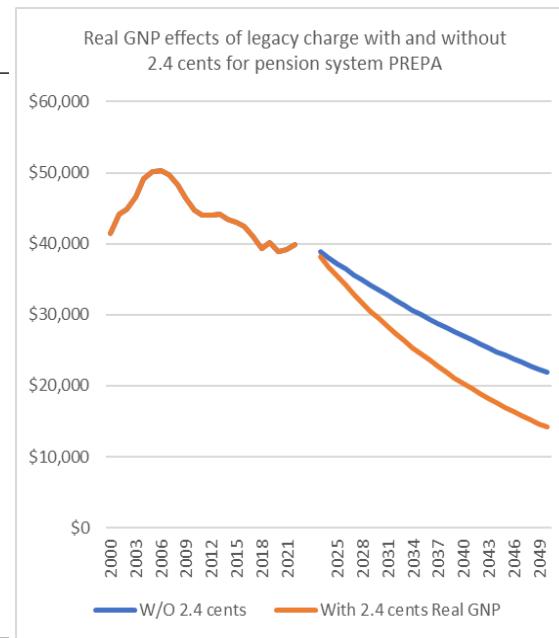
In addition to the Legacy Charge, the CFP includes an increase in c/kWh to cover the costs of PREPA's

PayGo Trust. This increase would be an additional 2.4 c/kWh.

The Effect on Real GNP

Table 17

FY	W/O 2.4 cents Real GNP	With 2.4 cents Real GNP	Gap
2023	\$38,875	\$38,202	-\$673
2024	\$38,039	\$36,796	-\$1,243
2025	\$37,204	\$35,414	-\$1,791
2026	\$36,403	\$34,108	-\$2,295
2027	\$35,628	\$32,865	-\$2,763
2028	\$34,876	\$31,677	-\$3,199
2029	\$34,141	\$30,534	-\$3,607
2030	\$33,421	\$29,432	-\$3,989
2031	\$32,716	\$28,369	-\$4,347
2032	\$32,025	\$27,343	-\$4,682
2033	\$31,344	\$26,348	-\$4,996
2034	\$30,677	\$25,387	-\$5,289
2035	\$30,022	\$24,461	-\$5,562
2036	\$29,386	\$23,572	-\$5,813
2037	\$28,764	\$22,719	-\$6,045
2038	\$28,154	\$21,894	-\$6,260
2039	\$27,562	\$21,105	-\$6,457
2040	\$26,980	\$20,342	-\$6,637
2041	\$26,410	\$19,607	-\$6,803
2042	\$25,854	\$18,901	-\$6,954
2043	\$25,314	\$18,224	-\$7,090
2044	\$24,787	\$17,574	-\$7,212
2045	\$24,272	\$16,950	-\$7,322
2046	\$23,771	\$16,351	-\$7,420
2047	\$23,282	\$15,775	-\$7,507
2048	\$22,807	\$15,224	-\$7,583
2049	\$22,345	\$14,695	-\$7,649
2050	\$21,893	\$14,187	-\$7,706

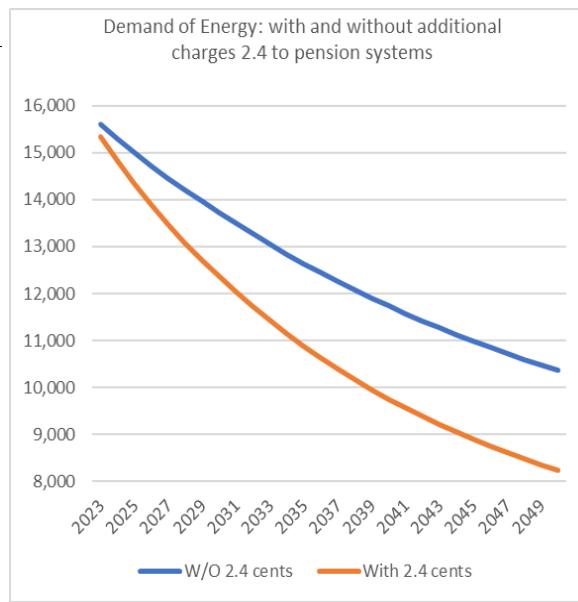


Graph 22

The Effect on Demand for Energy

Table 18

	W/O 2.4 cents Demand Energy	With 2.4 cents Demand Energy	Gap
2023	15,603	15,345	-\$258
2024	15,301	14,834	-\$467
2025	15,004	14,343	-\$661
2026	14,724	13,891	-\$832
2027	14,456	13,471	-\$985
2028	14,201	13,078	-\$1,122
2029	13,954	12,709	-\$1,245
2030	13,717	12,361	-\$1,356
2031	13,487	12,031	-\$1,456
2032	13,265	11,720	-\$1,545
2033	13,049	11,424	-\$1,625
2034	12,841	11,144	-\$1,697
2035	12,639	10,879	-\$1,761
2036	12,446	10,629	-\$1,817
2037	12,260	10,394	-\$1,866
2038	12,079	10,170	-\$1,909
2039	11,906	9,959	-\$1,947
2040	11,738	9,759	-\$1,979
2041	11,576	9,568	-\$2,007
2042	11,419	9,388	-\$2,032
2043	11,269	9,217	-\$2,052
2044	11,124	9,055	-\$2,069
2045	10,985	8,901	-\$2,083
2046	10,850	8,755	-\$2,095
2047	10,720	8,617	-\$2,104
2048	10,596	8,485	-\$2,111
2049	10,476	8,359	-\$2,116
2050	10,359	8,239	-\$2,120

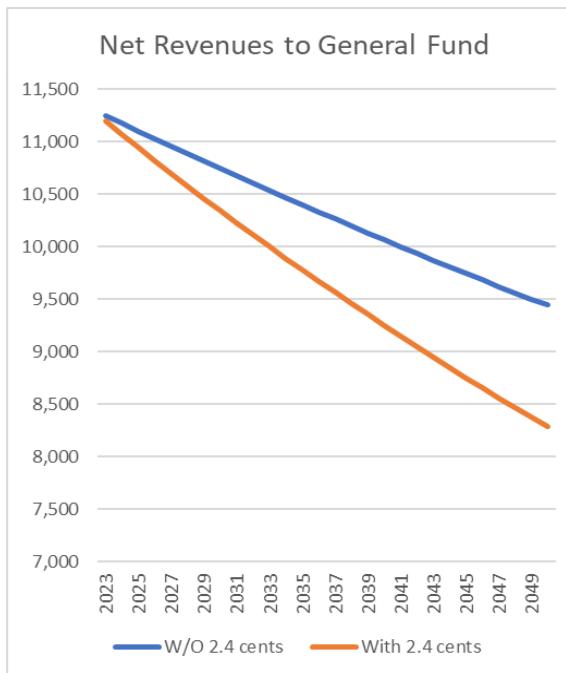


Graph 23

The Effect on Net Revenues to the General Fund

Table 19

	W/O 2.4 cents Net Revenue to GF	With 2.4 cents Net Revenue to GF	Gap
2023	11,252	11,199	-\$53
2024	11,178	11,072	-\$106
2025	11,102	10,944	-\$158
2026	11,029	10,820	-\$209
2027	10,957	10,699	-\$258
2028	10,885	10,580	-\$306
2029	10,815	10,462	-\$352
2030	10,745	10,346	-\$398
2031	10,675	10,231	-\$444
2032	10,606	10,118	-\$488
2033	10,536	10,004	-\$532
2034	10,467	9,892	-\$575
2035	10,399	9,781	-\$618
2036	10,331	9,672	-\$659
2037	10,264	9,564	-\$699
2038	10,197	9,458	-\$739
2039	10,131	9,353	-\$778
2040	10,065	9,249	-\$816
2041	10,000	9,146	-\$854
2042	9,935	9,045	-\$890
2043	9,871	8,945	-\$926
2044	9,808	8,847	-\$961
2045	9,745	8,750	-\$995
2046	9,683	8,655	-\$1,028
2047	9,622	8,562	-\$1,061
2048	9,562	8,470	-\$1,092
2049	9,502	8,379	-\$1,123
2050	9,443	8,290	-\$1,153

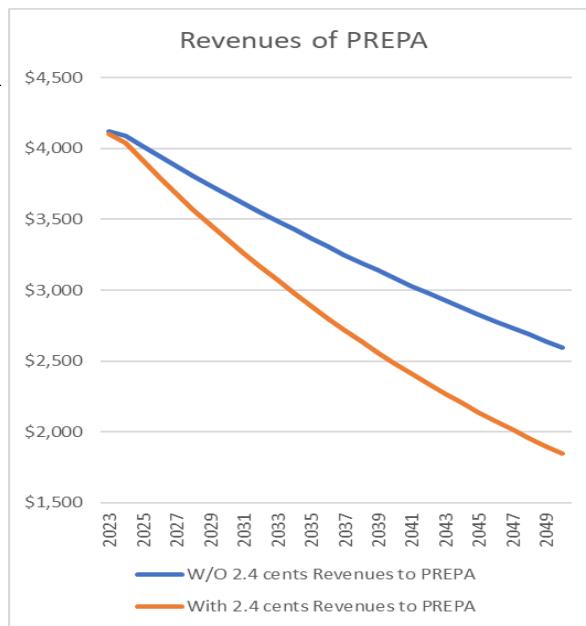


Graph 24

The Effect on Revenues to PREPA

Table 20

Fiscal Year	W/O 2.4 cents Revenues to PREPA	With 2.4 cents Revenues to PREPA	Gap
2023	\$4,123	4,100	-\$23
2024	\$4,089	4,037	-\$52
2025	\$4,017	3,915	-\$102
2026	\$3,944	3,794	-\$151
2027	\$3,875	3,679	-\$196
2028	\$3,807	3,569	-\$238
2029	\$3,741	3,463	-\$278
2030	\$3,676	3,360	-\$316
2031	\$3,613	3,261	-\$352
2032	\$3,550	3,164	-\$386
2033	\$3,488	3,070	-\$418
2034	\$3,428	2,978	-\$449
2035	\$3,368	2,889	-\$478
2036	\$3,309	2,803	-\$506
2037	\$3,251	2,719	-\$532
2038	\$3,195	2,638	-\$556
2039	\$3,139	2,560	-\$579
2040	\$3,085	2,484	-\$601
2041	\$3,031	2,410	-\$621
2042	\$2,979	2,339	-\$640
2043	\$2,927	2,269	-\$658
2044	\$2,877	2,203	-\$674
2045	\$2,828	2,138	-\$690
2046	\$2,779	2,076	-\$704
2047	\$2,732	2,016	-\$717
2048	\$2,686	1,957	-\$729
2049	\$2,641	1,901	-\$740
2050	\$2,597	1,847	-\$750



Graph 25

Conclusions

Puerto Rico's economy is going through structural problems, not cyclical. Puerto Rico is facing secular stagnation which implies a non-growth capacity in the long run. The analysis and information contained in the Certified Fiscal Plans demonstrate this secular stagnation. First, real GNP growth projections rarely achieve over 1% growth. See CFP, Exhibit 7, page 17. Second, the Commonwealth will face a deficit from 2026 without any sign of a surplus growth path. See CFP, Exhibit 10, page 20. Finally, federal funds have maintained a temporary and non-sustained short-term growth from 2016 to the present. See CFP, Exhibit 3, page 15. Thus, Puerto Rico's economy is not sustainable, and it has no competitiveness in the long term. To make matters worse, the Legacy Charge imposed in PREPA's Plan of Adjustment, as I conclude in my report, has a negative impact, not just for PREPA, but for the economy in general, since a decrease in the economic activity translates into less collections for the Commonwealth's General Fund.

As such, the proposed Legacy Charge has a bigger impact on the industrial and commercial sectors, but also affects the welfare of Puerto Rico's residents. The rate increases of the Legacy Charge deviate from the **threshold cost**, estimated at \$0.16, and project an increase without converging with that **threshold cost**. Furthermore, the Legacy Charge deviates from the theories of other economists, including the Board's own expert Andrew Wolfe, who estimated a **threshold cost** of \$0.21. This has a perverse effect on industrial sectors that make up Puerto Rico's economy.

Using six (6) equations, this study demonstrates that the Legacy Charge has a negative effect on the real growth of the Puerto Rican economy in the long term. It will also affect demand for kWh in industrial sectors, inducing decreased consumption. This decrease translates into fewer revenues for the Commonwealth's general fund, which risks compliance with the debt service obligations of the Commonwealth Plan of Adjustment. Furthermore, the reduction in energy demand will make PREPA's operations unsustainable, particularly when we consider PREPA's new revenue engagements through the PPPs, such as LUMA and GeneraPR.

Because “feasibility” means and refers to compliance with Section 314(b)(6) of PROMESA as interpreted by the Title III Court, it includes that the debtor entity can both pay its post-petition debt **and provide future public services at a level necessary to its viability.** See *In re Fin. Oversight & Mgmt. Bd.*, 637 B.R. 223, 302-03 (D.P.R. 2022). Electricity is not just an essential service; it is a human right. If PREPA cannot sustain its operations, it cannot provide future public services as necessary.

The imposition of the Legacy Charge, with or without the additional \$0.024 per kWh for the PayGo payments, creates a burden to Puerto Rico residents, as well as the industrial and commercial sector, which decreases revenue for the Commonwealth. Moreover, the payment of the Commonwealth restructured debt, PayGo pension payments and the transfers to the Commonwealth Trust Fund, in addition to the effects of the Legacy Charge, make the CPF unsustainable, as seen in

Table 21.

Table 21 Source: 2022 Commonwealth Certified Fiscal Plan, page 320.

Fiscal Year	W/O 2.4 cents		With 2.4 cents		Debt Services		Pensions	Trust	Sum	W/O 2.4 cents		With 2.4 cents	
	Net Revenue to GF	Net Revenue to GF	Re-structured	Pay Go	Pension	No CV	% Net Revenue	% Net Revenue		% Net Revenue	% Net Revenue		
2023	11,252	11,199	\$1,150	\$2,350	\$1,000	\$4,500	40.0%	40.2%					
2024	11,178	11,072	\$1,150	\$2,352	\$1,000	\$4,502	40.3%	40.7%					
2025	11,102	10,944	\$1,150	\$2,347	\$1,000	\$4,497	40.5%	41.1%					
2026	11,029	10,820	\$1,150	\$2,338	\$1,000	\$4,488	40.7%	41.5%					
2027	10,957	10,699	\$1,150	\$2,326	\$1,000	\$4,476	40.9%	41.8%					
2028	10,885	10,580	\$1,150	\$2,317	\$1,000	\$4,467	41.0%	42.2%					
2029	10,815	10,462	\$1,150	\$2,309	\$1,000	\$4,459	41.2%	42.6%					
2030	10,745	10,346	\$1,150	\$2,300	\$1,000	\$4,450	41.4%	43.0%					
2031	10,675	10,231	\$1,150	\$2,291	\$1,000	\$4,441	41.6%	43.4%					

Note 3 Amounts in million \$, except %.

The last two columns of **Table 21** show the percentage of projected revenues destined to pay debt service, PayGo pension payments and the Commonwealth Trust Fund. In the scenario where the additional \$0.024 kWh is not included, by 2031, the percentage of projected revenue increases from 40% to 41.6%. In the alternate scenario, including the additional increase, by 2031 the projected percentage increases from 40.2% to 43.4%. By 2031, there would be between 60% and 57% available

revenue to cover essential services, among the other expenses that need to be covered with the General Fund.

In conclusion, the imposition of the Legacy Charge makes all the assumptions established in the CFP unsustainable and with them the ability of the Commonwealth to pay debt service pursuant to its own Plan of Adjustment.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief.



José I. Alameda Lozada, Ph.D.

April 28, 2023

ANNEX 2

JOSE ISRAEL ALAMEDA LOZADA; Ph.D.; Economist and economic planner

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PERSONAL INFORMATION

EDUCATION: Ph.D. Economics, 1996, The University of Wales,
Aberystwyth, Wales, United Kingdom.

Master in Arts, Economics, 1983.
Rutgers University, New Brunswick
New Jersey, United States

Master in Planning, 1976.
University of Puerto Rico
Graduate School of Planning
Río Piedras, Puerto Rico

Business Administration, B.B.A., 1972.
University of Puerto Rico
Mayagüez, Puerto Rico

FIELD OF INTEREST: International Trade, Economics of Finance, Econometrics, Energy Economics, Economic Development, Money and Banking, Health Economics, Managerial Economics, Comparative Economics, Business Cycles and Forecasting, Torts and Injury damages.

CLASSES TAUGHT: Macroeconomics and Microeconomics, Managerial Economics, Comparative Economics Systems, Mathematics for Economists, Economic Development of Puerto Rico, International Trade and Finances, Business Cycles.

LANGUAGE: Spanish and English

PROFESSIONAL EXPERIENCE

Professional Planner Certified (Lic. #256), inactive.

1998 up to now- Full Professor in Economics, Department of Economics, UPR at Mayagüez.

1992--1997--Associate Professor, Department of Economics, University of Puerto Rico, Mayagüez.

1993-1994 -- Economic Advisor of the Chamber of Commerce of Puerto Rico-Western

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2014—FULL PROFESSOR UPR MAYAGUEZ

2014---Planning Board economic consultant—Strategic Plan of Development for Puerto Rico—Retail Trade, Wholesale Trade and Transportation and Warehousing Sectors.

1992- present—Researcher and consultant in cases of Forensic Economics.

1986-at present, Consultant in Economics and Planning, the Commonwealth Planning Board of Puerto Rico.

1986-87, Consultant in Economics, Economic Development Administration, U.S. Department of Commerce

1984-85, Instructor, Department of Finance, University of Puerto Rico, Río Piedras Campus.

1984-86, Associate Research, Center for Business Research Department of Business Administration, U.P.R. Rio Piedras, Puerto Rico.

1983-84, Special Commission for the Development of Puerto Rico Senate of Puerto Rico.

1983, Consultant for the Master Plan for the Development of Aguadilla, CEMI, Inc.;

1982-83, Instructor, Department of Economics, Mayagüez campus.

1981-82, Visiting Lecturer, Puerto Rican Studies, Livingston College, Rutgers University, Piscataway, New Jersey

1980-81, Teaching Assistant, Livingston College.

1980, Teaching Assistant, Rutgers University.

1976-79, Instructor, Department of Economics and Business Administration Interamerican University of Puerto Rico

1974-75, Research Assistant, Logic Research Inc., Santurce, Puerto Rico.

JOSE ISRAEL ALAMEDA LOZADA

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RESEARCH EXPERIENCE AND PUBLICATIONS

(Many papers and research excluded)

Books:

1. **La Economía del Diario Vivir: análisis económico de los asuntos públicos cotidianos desde el deporte, la organización política y el status de Puerto Rico.** Editorial Búsqueda. July, 2005.
2. **Ensayos en Economía Aplicada: análisis y medición del impacto social, político y económico de las instituciones sobre la economía de Puerto Rico:** octubre del 2005
3. **La Vivienda de Interés Social en Puerto Rico.** libro realizado para el Departamento de la Vivienda, co-autor Profesor Carlos Rivera Galindo. 2005. Printed by *Advance Graphic Printing, Chicago, IL.*
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6. **Propuesta para una Nueva Estrategia de Desarrollo para Puerto Rico: Sustentabilidad, Equidad y Seguridad Social:** with Colectivo de Economistas Universitarios (with A. Gonzalez, Jeffrey Valentin Mari, Jose Toral, José Garcia y Myrna Comas Pagán, Editorial Situm, 2013.

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JOSE ISRAEL ALAMEDA LOZADA

-8-

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JOSE ISRAEL ALAMEDA LOZADA

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SERVICES REALIZED AS ECONOMIC ADVISOR OR CONSULTANT

1. *Universidad de Puerto Rico, Recinto de Mayagüez* (oficina del Rector-estudio sobre de costo-beneficio sobre el R/V Chapman (con Dr. Leandro Colón);

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2. *Universidad de Puerto Rico, Recinto de Mayagüez* (oficina del Rector-estudio sobre el impacto económico del RUM (con Dr. Edwin Irizarry Mora), utilizado por el RUM en una presentación hacia la Asamblea Legislativa)
3. *Centro de Desarrollo Económico de la UPR (Estudio sobre el Impacto Económico de Porta del Sol); realizado para la Compañía de Turismo de Puerto Rico;*
4. *Junta de Planificación –Planning Board* (estudio de fondo para el Informe Económico al Gobernador 2006 sobre las Trayectoria de los Ciclos Económicos de Puerto Rico y el Informe Económico 2008, Economía de Estados Unidos);
5. *Oficina de Gerencia y Presupuesto* (Office of Budget and Management, Commonwealth of Puerto Rico 2008.
6. *Autoridad para el Financiamiento de la Infraestructura* (studies about XXI Central American Games, 2010, and solid wastes-transshipment station at Trujillo Alto).
7. *Administración de Compensaciones por Accidentes de Automóviles (ACAA), Estudio del Impacto Económico de los Accidentes de Tránsito en Puerto Rico;* <http://economia.uprrp.edu/Ensayo%20138josealamedayuanlara.pdf>.
8. *Gobierno Municipal de Mayagüez*, Impacto Económico de los Juegos Centroamericanos y del Caribe 2010.
9. *Departamento de Agricultura de Puerto Rico: tres estudios de viabilidad:*
10. *Asociación de Dueños de Talleres de Reparación Colisión de Autos (estudio sobre el costo de los servicios y la fijación de tarifas por parte de las aseguradoras-study about insurance payment and charges) ;*
11. *Frente Unido de Camioneros de Puerto Rico (estudio sobre las tarifas de los camioneros presentados a la Comisión de Servicio Público—study about cargo freight and charges).* 2002
12. *Colegio de Médicos y Cirujanos de Puerto Rico, (estudio el impacto económico de la reforma de salud para presentarse en la Comisión Evaluadora de la Reforma de Salud de Puerto Rico; Epilepsy Study);*
13. *Asociación de Detallistas de Gasolina de Puerto Rico (caso sobre el impacto del salario mínimo, proyecto de Ley—study about mininum wages),*
14. Department of Health; Demand and Supply of Physicians and Health Costs.
15. *Asociación Puertorriqueña de Dueños de Laboratorio Clínico Privado (caso sobre demanda a aseguradoras, estudio para el Federal Trade Commission (FTC));*

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16. *Asociación de Farmacias de la Comunidad* (estudio comprensivo sobre la situación económica de las farmacias de la comunidad-- 4 de febrero del 2005);
17. *Sociedad de Radiología de Puerto Rico, Inc*; (estudio sobre el efecto de la fijación de tarifas por parte de las aseguradoras en los laboratorios de radiología en Puerto Rico, abril de 2004, estudio para el FTC).
18. *Cooperativa de Ahorro y Crédito de Aguada*; Estudio sobre la viabilidad de una sucursal en Mayagüez; septiembre 2005.
19. *Cooperativa Cash-Coop (Estudio de viabilidad para el establecimiento de una cooperativa de establecimientos dedicados al cambio de cheques y otros servicios financieros, Cooperativa CashCoop, July 2004)*.
20. *Movimiento para el Desarrollo de Oeste (estudio sobre la inversión privada y pública en Carreteras en el Oeste)*.
21. *Educadores Puertorriqueños en Acción Ciudadana, (Estudio para determinar la diferencia salarial entre los supervisores, superintendentes de escuelas y los directores de escuela en Puerto Rico: 22 de abril de 2004)*.
22. *Asociación Puertorriqueña de Dueños de Laboratorios Clínicos Privados*.
23. *XXI Central American Games Organization*: (economic and financial advisor).
24. *Alianza Ciudadana para la Energía Renovable, University of Puerto Rico at Mayagüez campus (studies about energy conservation, renewable resources, public authorities, etc)*
25. *Instituto Tropical de Economía, Ambiente y Sociedad, sponsored by the University of Puerto Rico at Mayagüez*.
26. *UTIER*. The Unión de Trabajadores de la Industria Eléctrica y Riego.
27. *PROSOL-UTIER*, Programa de Solidaridad UTIER. Unión Obrera creada por la Unión de Trabajadores de la Industria Eléctrica y Riego.
28. Consultant Department of Treasury (Hacienda)—2015-16. Co-author study Sales and Used Tax index of Complaint: Merchandises and Services.
29. Administrador Judicial para el gobierno municipal de Añasco. Caso de propiedades *Municipio de Añasco v. Community Action for Social Affairs and Housing Development Organization of Puerto Rico, Inc.* et.al. Caso Civil Núm: ISCI2009-00654.
30. Consultor para el Colegio de Productores de Espectáculos Públicos (COPEP),
31. Economic Consultant, Cámara de Mercadeo, Industria y Distribución de Alimentos (MIDA); 2016

HONORS and PROFESSIONAL PARTICIPATIONS:

- : *Comité de los 24*: Participation at an active member, sponsored by Office of the Governor of Puerto Rico April 2014.
- : Outstanding Researcher of the Faculty of Arts and Science, 2013 (*See letter attached*).
- : Most Outstanding Student in the Concentration of Economic Planning June 1973. Graduate School of Planning from the University of Puerto Rico.
- : Presidential Fellowship for Graduate Studies Abroad, University of Puerto Rico. June 1980.
- : Participant in the 2008 Fed in the 21th Century Symposium for College Professors at the New York Federal Reserve Bank. :Participant in the 2011 to *Fed in the for College Professors* at the New York Federal Reserve Bank
- : Who's Who Marquis. Finance and Industry. 27th Edition, 1992-93.
- Member **Comité de Auditoria de la Deuda Pública de Puerto Rico: 2016. Senate and House of Representative of Puerto Rico.**

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Universidad de Puerto Rico – Mayagüez
Decanato de Asuntos Académicos
Centro de Enriquecimiento Profesional (CEP)
Academia de Investigación para Facultad y Postdoctorales
Research Academy for Faculty and Postdoctoral Fellows



29 de abril de 2013

Dr. José Alameda
Profesor, Facultad Artes y Ciencias
Universidad de Puerto Rico, RUM

Estimado Dr. Alameda:

La Academia de Investigación para Facultad y Postdoctorales tiene el honor de informarle que usted ha sido seleccionado para recibir un homenaje especial como investigador destacado del Decanato de Artes y Ciencias en la actividad de reconocimiento dentro del Simposio titulado "**La investigación y labor creativa en el RUM como promotor de cambios socioeconómicos en Puerto Rico**" que se llevará a cabo el día 10 de mayo de 2013, a las 8:30 am en el Edificio de Administración de Empresas.

En muestra del agradecimiento a la ardua labor a los investigadores destacados de nuestro recinto la Academia de Investigación para Facultad y Postdoctorales le solicitó a su Decanato de Artes y Ciencias que estableciera criterios para seleccionar y otorgarle a profesores un merecido reconocimiento especial. Su decanato utilizó los criterios de número de publicaciones/patentes entre 2011-presente, número de propuestas sometidas/aprobadas en los últimos dos años, desempeño general en la enseñanza y atendiendo estudiantes en investigación en su campo. Es nuestro honor informarle que siguiendo dichos criterios, usted fue seleccionado por su decanato para recibir el homenaje de reconocimiento como investigador destacado.

Desde el pasado año el Centro de Enriquecimiento Profesional (CEP) y el Centro de Investigación y Desarrollo (CID) junto a los decanos asociados de investigación de las cuatro facultades académicas han estado colaborando en el desarrollo de la *Academia de Investigación para Facultad y Postdoctorales* con miras de ayudar a articular un plan concertado que fomente la competitividad y la excelencia en la investigación en el RUM. Como parte de nuestro esfuerzo por motivar y reconocer la importante labor investigativa que se realiza en nuestra institución, llevaremos a cabo este simposio multidisciplinario con la participación de investigadores de las cuatro facultades. Esta será una oportunidad única para compartir hallazgos, quehaceres, estrategias y establecer colaboraciones más allá de nuestras paredes disciplinarias.

El Simposio culminará con la actividad de reconocimiento a la labor de excelencia de los investigadores homenajeados en el Anfiteatro de ADEM a las 4:30 pm. Puede encontrar la agenda de las actividades del Simposio en la siguiente dirección: <http://academia-de-investigacion.uprm.edu>. Será un honor contar con su presencia.

Cordialmente;

Ubaldo M. Córdova, Ph. D.
Coordinador Academia de Investigación
CEP – Asuntos Académicos



Academia de Investigación para Facultad y Postdoctorales
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JOSE ISRAEL ALAMEDA LOZADA

El doctor José I. Alameda Lozada es actualmente Catedrático del Departamento de Economía del Recinto Universitario de Mayagüez. Ha sido, además consultor de la Junta de Planificación y de la Comisión Pro Sede de las Olimpiadas del 2004 y de la organización que patrocina la celebración de los Juegos Centroamericanos y del Caribe en el 2010, en la zona oeste. Durante el 1989 al presente ha sido asesor económico de numerosas instituciones, agencias del gobierno y empresas privadas.

Posee un bachillerato en Administración de Empresas con concentración en Economía (1973) del Recinto Universitario de Mayagüez y obtuvo una maestría en Planificación Económica (1976) de la Escuela Graduada de Planificación de la Universidad de Puerto Rico, donde recibió el premio del estudiante más destacado dentro de la especialización de Economía. En el 1982, obtuvo el grado de maestría en Economía con concentración en economía monetaria y economía internacional de la Universidad de *Rutgers* del estado de Nueva Jersey. Posee un doctorado en Economía de la Universidad de Gales en el Reino Unido (1996), concentrando su tesis en el análisis de la transmisión del ciclo de la economía de Estados Unidos a la de Puerto Rico.

Ha sido profesor de la Universidad Interamericana (1976-79), profesor visitante en la Facultad de Estudios Puertorriqueños de la Universidad de *Rutgers* (1980-81), Investigador Asociado en el Centro de Investigaciones Comerciales de la Facultad de Administración de Empresas del Recinto de Río Piedras (1983-85), Profesor de Finanzas del Departamento de Finanzas del Recinto de Río Piedras (1984-85). Realizó labores como economista en la Comisión Especial para el Desarrollo del Senado de Puerto Rico (1985) y Asesor Económico de la Presidenta de la Junta de Planificación (1985-87).

Ha publicado extensamente en Puerto Rico, en Estados Unidos y en el Reino Unido artículos sobre el desarrollo económico, energía, recursos humanos, el sector financiero y los fondos 936, el impacto económico del SIDA en Puerto Rico, impacto económico de la criminalidad, viabilidad de los Juegos Olímpicos del 2004, y Centroamericanos y del Caribe 2010, entre otros. Fue uno de los pioneros en toda la América de estudiar el SIDA desde la perspectiva económica, presentado su trabajo en la Convención Internacional sobre el SIDA en la ciudad de Montreal, Canadá en el 1989. Ha realizado presentaciones de sus investigaciones en Chile, Costa Rica, República Dominicana, Inglaterra, Estados Unidos, entre otros países. Fue seleccionado para aparecer en *Who's Who de Marquis* en Finanzas e Industria, edición número 27, 1992-93. Recibió el premio de investigador destacado de la Academia de la Facultad de Artes y Ciencias del RUM en 2013.

Tiene publicados seis libros: (1) **La Economía del Diario Vivir: análisis de los asuntos cotidianos desde la organización social y deportiva hasta el status político** (2004) ; (2) **Ensayos en Economía Aplicada: Análisis y medición del impacto social, político y económico de las instituciones sobre la economía de Puerto Rico** (2004); (3) **La Vivienda de Interés social en Puerto Rico** (2002), este último con el Profesor Rivera Galindo y hecho para el Departamento de la Vivienda de Puerto Rico; (4) **Índice para la Medición del Bienestar Económico en Puerto Rico (2009)**-- con la doctora Ivonne Díaz Rodríguez, catedrática del RUM y experta en economía ambiental; (5) **La Política Neoliberal en Puerto Rico y la Ley Número 7: Impacto y Consecuencias Socio-Económicas: Años Fiscales 2009 al 2011** (2012) (Editorial Situm); y **Una nueva estrategia de desarrollo: sustentabilidad, equidad y seguridad social** (2013) con **Colectivo de Economistas Universitarios** (Editorial Situm).

Fue coordinador y fundador del Comité de Ciclos Económicos de la Asociación de Economistas de Puerto Rico, institución en la cual es socio fundador. En la misma ha ocupado puestos en la Junta de Directores tales como Secretario (1989-90) y Tesorero (1991-92). Nombrado al **Comité de Auditoria de la Deuda Pública de Puerto Rico: 2016. Senado and Cámara de Representantes of Puerto Rico**.

ANNEX 3

(Appendix to the Opening Expert Report José I. Alameda Lozada, Ph.D.)

Appendix 1

Forecasting costs per kWh for Industrial, Commercial and Residential

Puerto Rico Energy Power Authority (PREPA)

The first step relies upon the estimation of cost per kWh with and without the TC. The time frame considered is from historical 2000 to 2019 and forecasting for 2022 to 2050. The basic regression equation is:

$$\text{Cost -per- kWh (cents)} = f(\text{West-Texas Intermediate (2022 price)}, \text{Henry Hubb Gas price (2022 prices)}).$$

The two independent variables are:

- West-Texas Intermediate (2022 price);
- Henry Hubb Gas price (2022 prices).

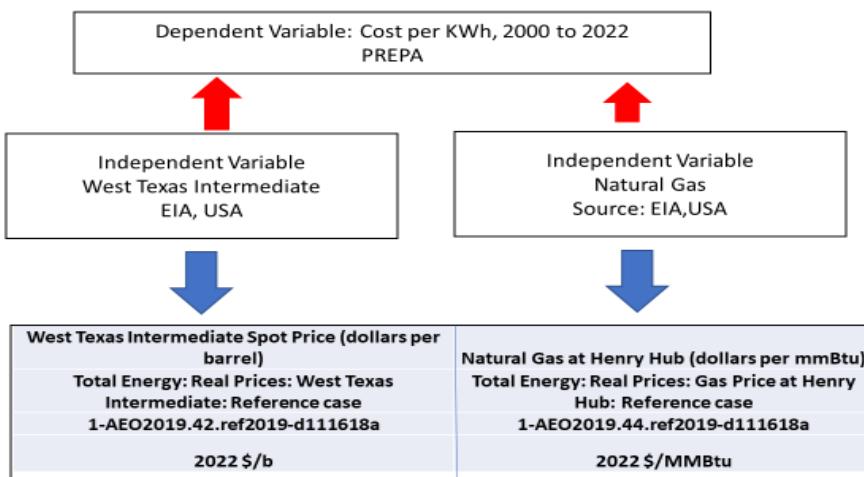
The information came from **Energy Information Administration: [U.S. Energy Information Administration - EIA - Independent Statistics and Analysis](#)**.

https://www.eia.gov/outlooks/aoe/data/browser/#/?id=3-o2019&cases=ref2019~ref_no_cpp&sourcekey=0.

The dependent variable is from PREPA-Statistics:

- Cost-per-kWh from PREPA. (<https://www2.aepr.com/aeees/estadisticas.asp>). Each sector commercial, industrial, and residential.

In 2020, PREPA's net generation was mainly based upon oil derived fuels by 70% and natural gas by near 30%, thereby, the cost equation must take on account both fuel inputs mix. Notwithstanding, at the future, this mix will be bias toward natural gas. Then the model will be as follow:



The equation of cost shall be tested as follow:

- Costs per kWh (cents) = f (West-Texas Intermediate (2022 price), Henry Hub Gas price (2022 prices)).
- The Costs per kWh (cents) are for industrial, commercial, and residential sectors.

Each equation will be tested on the time series procedure of Cointegration Fully Modify OLS (FMOLS).

Several authors have claimed that cointegration, either Dynamic OLS (DOLS) or Fully Modified OLS (FMOLS) are both superior to the traditional statistical OLS: (1) OLS estimates are super-consistent, but the t-statistic obtained without stationary or $I(0)$ terms are only approximately normal (see Arize, Malindretos and Ghosh (2015) in *International Review of Economics and Finance*¹. Also, see Arize, Osang and Slottje (2000) in *Journal of Business & Economic Statistics*²).

FMOLS is a non-parametric approach used to dealing with serial correlation found at time series data. Dynamic OLS (DOLS) is an alternative (parametric) approach in which lags and leads are introduced to cope with the problem irrespectively of the order of integration and the existence or absence of cointegration. Either DOLS or FMOLS are usually preferred to the OLS estimator because they take care of small sample bias but also the endogeneity bias by taking the leads and lags of the first-differenced regressors.

The different results are shown at the following slides. These results meant different scenarios about the future cost of kWh at industrial, commercial, and residential.

Forecasting the Total Cost per kWh

Dependent Variable: COSTOKWHP

Method: Fully Modified Least Squares (FMOLS)

Date: 04/07/23 Time: 21:05

Sample (adjusted): 2001 2022

Included observations: 22 after adjustments

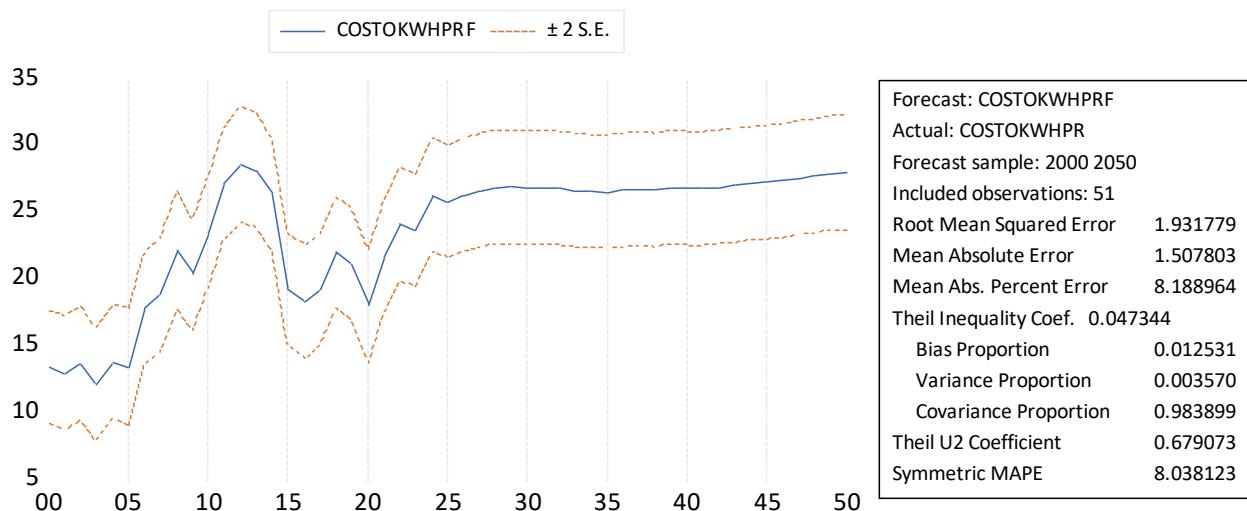
Cointegrating equation deterministics: C

Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL_GAS_AT_HENRY_HUB	-1.225778	0.177695	-6.898213	0.0000
WEST_TEXAS_INTERMEDIATE_SPO...	0.206758	0.014401	14.35668	0.0000
C	12.48650	1.097984	11.37220	0.0000
R-squared	0.843837	Mean dependent var	20.06718	
Adjusted R-squared	0.827399	S.D. dependent var	4.923617	
S.E. of regression	2.045531	Sum squared resid	79.49977	
Long-run variance	2.400682			

¹ *Purchasing power parity-symmetry and proportionality: Evidence from 116 countries*. Augustine C. Arize a, John Malindretos, and Dilip Ghosh. International Review of Economics and Finance. See <https://www.sciencedirect.com/science/article/abs/pii/S1059056014001956>.

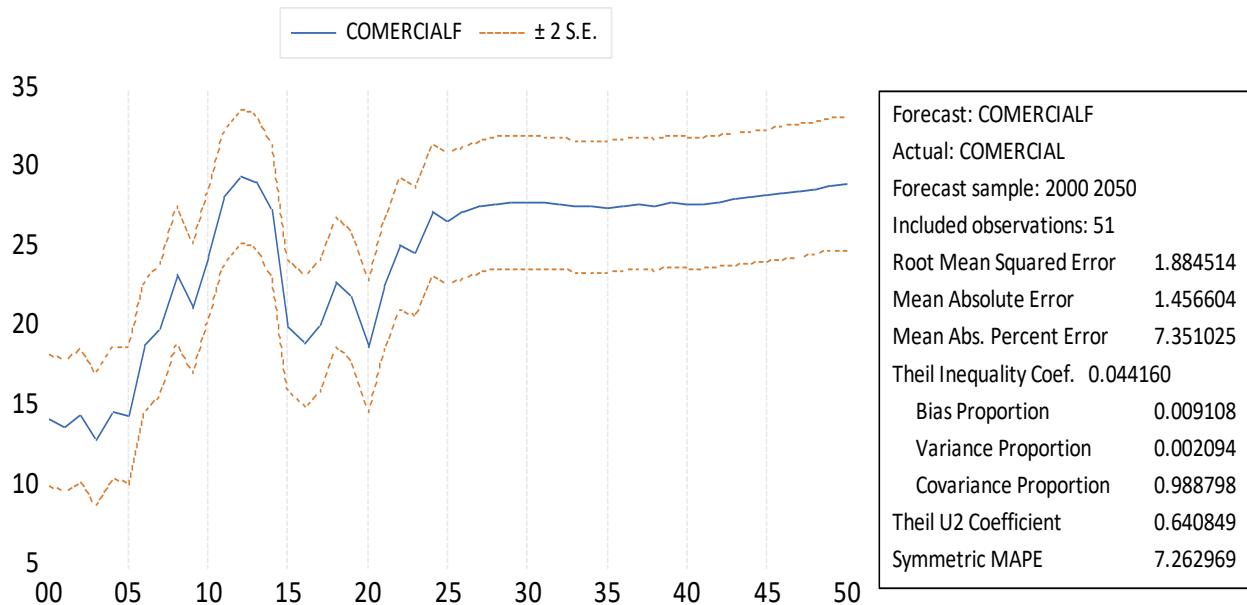
² **Exchange-Rate Volatility and Foreign Trade: Evidence from Thirteen LDC's.** Augustine C. Arize, Thomas Osang and Daniel J. Slottje. Vol. 18, No. 1, January 2000. **Journal of Business & Economic Statistics.** American Statistical Association, pp. 10-17.



Forecasting Commercial cost

Dependent Variable: COMERCIAL
 Method: Fully Modified Least Squares (FMOLS)
 Date: 04/07/23 Time: 20:48
 Sample (adjusted): 2001 2022
 Included observations: 22 after adjustments
 Cointegrating equation deterministics: C
 Long-run covariance estimate (Bartlett kernel, Newey-West fixed
 bandwidth = 3.0000)

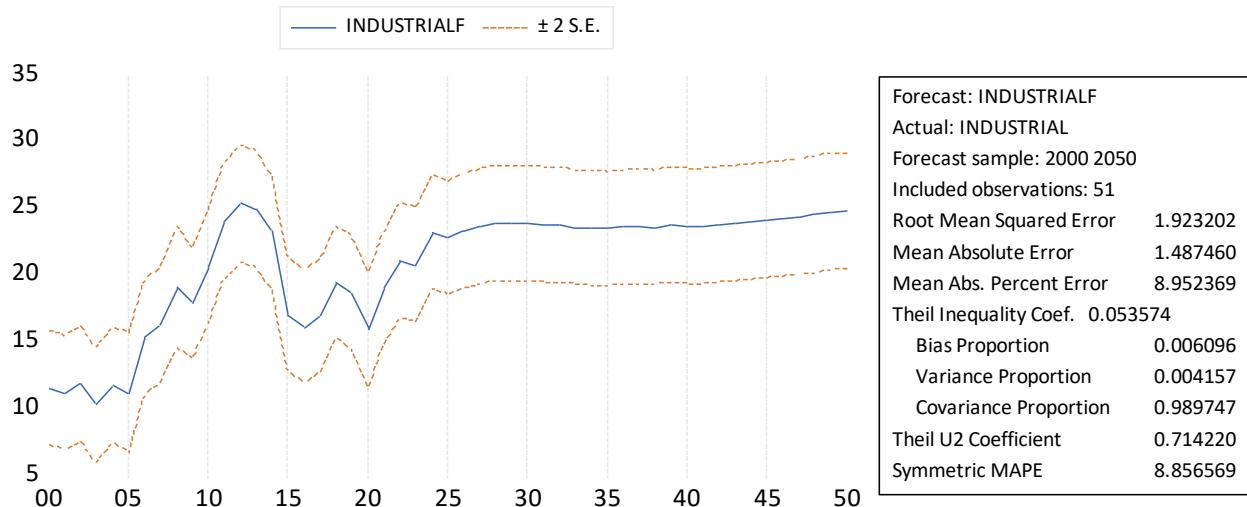
Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL_GAS_AT_HENRY_HUB	-1.196160	0.151493	-7.895810	0.0000
WEST_TEXAS_INTERMEDIATE_SPO...	0.210734	0.012278	17.16364	0.0000
C	13.03520	0.936081	13.92530	0.0000
R-squared	0.852526	Mean dependent var	21.02118	
Adjusted R-squared	0.837002	S.D. dependent var	5.000733	
S.E. of regression	2.018947	Sum squared resid	77.44679	
Long-run variance	1.744894			



Forecasting Industrial cost

Dependent Variable: INDUSTRIAL
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 20:45
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed
bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WEST_TEXAS_INTERMEDIATE_SPO...	0.186880	0.015584	11.99181	0.0000
NATURAL_GAS_AT_HENRY_HUB	-1.197609	0.192285	-6.228304	0.0000
C	11.14808	1.188136	9.382831	0.0000
R-squared	0.812453	Mean dependent var	17.63286	
Adjusted R-squared	0.792711	S.D. dependent var	4.529738	
S.E. of regression	2.062345	Sum squared resid	80.81207	
Long-run variance	2.811089			



Forecasting Residential cost

Dependent Variable: RESIDENCIAL
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 20:51
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed
bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL_GAS_AT_HENRY_HUB	-1.123928	0.195472	-5.749810	0.0000
WEST_TEXAS_INTERMEDIATE_SPO...	0.204053	0.015842	12.88026	0.0000
C	11.61968	1.207830	9.620294	0.0000
R-squared	0.828398	Mean dependent var	19.46130	
Adjusted R-squared	0.810334	S.D. dependent var	4.861562	
S.E. of regression	2.117240	Sum squared resid	85.17140	
Long-run variance	2.905054			

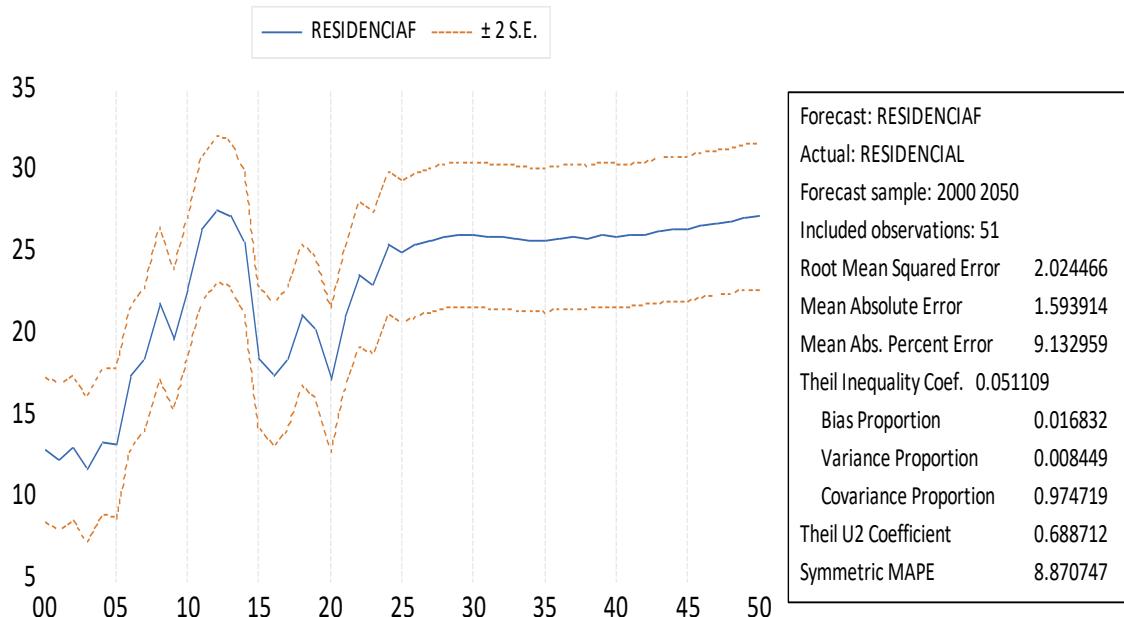


Table A-1

Forecasted Costs per kWh: Puerto Rico
Cents of a dollar.

Fiscal Years	Total Cost kWh	Commercial Cost kWh	Industrial Cost kWh	Residential Cost kWh
2023	23.77	24.81	20.87	23.20
2024	26.34	27.38	23.31	25.64
2025	25.83	26.82	22.90	25.09
2026	26.36	27.33	23.41	25.57
2027	26.67	27.65	23.72	25.87
2028	26.89	27.86	23.92	26.08
2029	26.96	27.93	23.97	26.14
2030	26.94	27.92	23.95	26.14
2031	26.90	27.89	23.90	26.10
2032	26.85	27.85	23.85	26.08
2033	26.69	27.69	23.68	25.93
2034	26.64	27.65	23.62	25.89
2035	26.59	27.60	23.56	25.85
2036	26.74	27.76	23.70	26.00
2037	26.81	27.83	23.76	26.08
2038	26.73	27.76	23.67	26.01
2039	26.93	27.96	23.87	26.20
2040	26.84	27.87	23.77	26.12
2041	26.84	27.88	23.76	26.13
2042	26.94	27.98	23.85	26.23
2043	27.10	28.14	24.00	26.38
2044	27.23	28.27	24.12	26.51
2045	27.31	28.35	24.19	26.58
2046	27.46	28.51	24.33	26.73
2047	27.60	28.64	24.46	26.86
2048	27.77	28.81	24.61	27.03
2049	28.00	29.04	24.83	27.25
2050	28.06	29.11	24.89	27.31

Note: The standard errors are closely to 2.0. Then the estimates should be within \pm 4 cents per kWh.